

Industrial Arts

BULLETIN 331

IN PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION
HARRISBURG



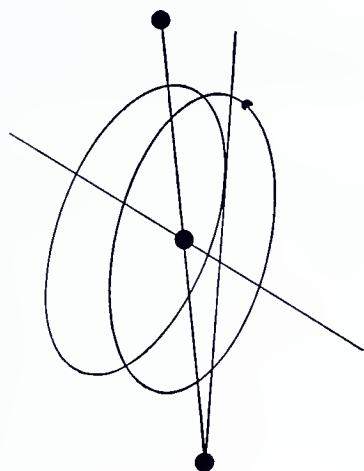


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Related Subjects at Derry Township

Foreword

The complex organization of machines, materials, processes, and people which is industrial Pennsylvania compels attention in the educational program. This is the learning area of Industrial Arts. This is not a new subject but one of many years' growth which now comes to the fore as a requirement in the junior high school program and an essential offering at the senior high school level.

This bulletin presents to school administrators, supervisors, and teachers the various aspects of providing, organizing, and conducting Industrial Arts in the secondary school.

The work of preparing this bulletin was organized by Robert T. Stoner, Chief, Trade and Industrial Education, under the general direction and guidance of Paul L. Cressman, Director of the Bureau of Instruction. Final editing was done by Rachel S. Turner, Editor for the Department of Public Instruction.

September 1951

Francis B. Hoar

Superintendent of Public Instruction



Graphic Arts of the State Teachers
College of California

Acknowledgments

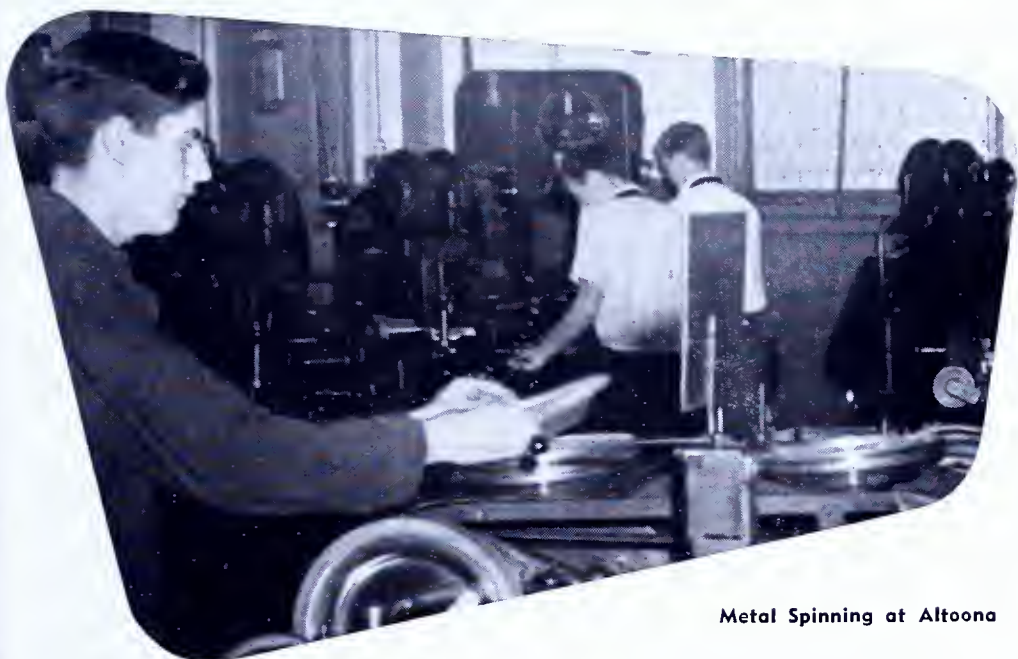
The members of the Industrial Arts Bulletin Committee were appointed by the Superintendent of Public Instruction during the fall of 1949.

The Committee is representative of the various sections of the State and the various types of services. It includes Industrial Arts Teachers, Industrial Arts Teacher-Education Teachers, and Area Coordinators of Trade and Industrial Education.

The personnel of this committee, listed on page viii, worked independently in their local situations and from one to three days each as a Committee in the Department of Public Instruction. The State paid the expenses of the committee while working as a committee in Harrisburg, but the local boards of education gave the necessary leaves with compensation. The cooperation of all concerned has been wholehearted and sincere.

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Metal Spinning at Altoona

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Art Metal at Lebanon

The Historical Aspects and the Future

Origin, Development, and Terminology

Definition of Industrial Arts

Industrial Arts and Vocational-Industrial Education

Distinction Between Industrial Arts and

Vocational-Industrial Arts Education

Industrial Arts an Heir of Manual Training

Definition of Manual Training

Definition of Sloyd

Manual Arts in 1900

Future Trends in Industrial Arts

Industrial Arts Origin, Development, and Terminology

I. Introductory

Definition of Industrial Arts

THE MOST generally accepted definition of Industrial Arts is to be found in a United States Government publication on the subject: "Industrial Arts is a phase of general education that concerns itself with the materials, processes, and products of manufacture, and with the contribution of those engaged in industry. The learnings come through the student's experiences with tools and materials and through his study of resultant conditions of life. It is a curriculum area rather than a subject or course, being comparable in this respect to the language arts."

"Industrial Arts, therefore, has general values that apply to all levels, and in a continuous program these values are progressively intensive and are cumulative in their effect as the student advances in maturity."¹

Industrial Arts and Vocational Industrial Education

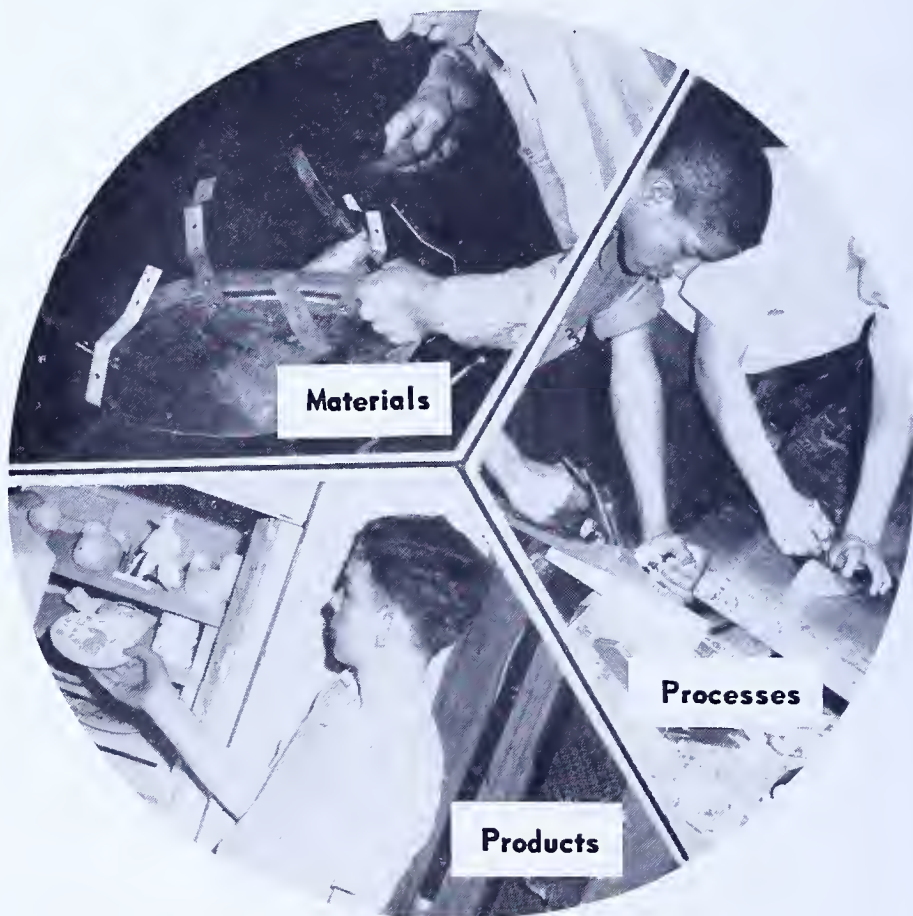
Manual Arts was an all-inclusive term applied to shopwork in schools or institutional programs. As the movement grew in popularity its contributions to general education objectives and to pre-employment training in skills and technical knowledges were generally recognized. The passage of the Smith-Hughes Act by Congress in 1917 established a distinctive pattern of standards for pre-employment industrial training for purposes of special Federal financial aid. The term Vocational Industrial Education was used in the Act and has therefore a specific meaning in terms of objectives and organization.

The general education shop program continued to grow with a reevaluation of objectives and methods after 1917 under the title of Industrial Arts Education. It differs greatly in organization of instruction and methods of teaching and should not be confused with vocational instruction.

¹ United States Department of the Interior, Office of Education, *Industrial Arts, Its Interpretation in American Schools*, Bulletin 1937, No. 34, 1938, p. 1.

Industrial Arts utilizes a wide variety of industrial materials requiring tools and equipment common to industry to enable the student to experience the uses of the materials and the functions of tools and equipment in our industrial economy. On the other hand, Vocational Industrial Education is planned to give the student work-experience

"Industrial Arts . . . concerns itself with materials, processes and products . . ."



Photos courtesy of Erie and Quokertown Public Schools

on operations and jobs as found from an analysis of a specific trade, together with related and general subject matter composing a specific pre-employment high school curriculum.

Distinction between Industrial Arts and Vocational Industrial Education

The distinction [between Industrial Arts and Vocational Industrial Education] is one of controlling purpose. Industrial Arts Education is considered a phase of general education that involves both a study of, and experience with, the materials, processes, products, and occupations of an industrial society. Its objectives are concerned with orientation, avocational interests, consumer literacy, manipulative skills, training in home mechanics, social understandings, and cultural relationships. Vocational Industrial Education, on the other hand, aims to fit for useful and gainful employment by providing the necessary training in a specific occupation or family of occupations.

One of the functions of Industrial Arts instruction in seventh, eighth, and ninth grades is to assist the student in making an occupational choice by providing exploratory experiences which form a basis for intelligent vocational planning. A strong, effective program of Industrial Arts is thus a prerequisite for a sound program of trade and industrial education. It enables students to make a more intelligent selection of a vocation and allows them to enter vocational classes with work habits, some skills, and appreciations which are useful in their chosen work. Industrial Arts Education, continued as an elective course in tenth, eleventh, and twelfth grades, contributes to the educational growth of students by developing a better understanding and appreciation of the factors involved in our industrial society, and by cultivating avocational skills that make for more effective life adjustment in a highly mechanized civilization.¹

Industrial Arts an Heir of Manual Training

Industrial Arts fell heir to the best thought that a half century of manual training had produced and to the teaching techniques refined by three generations of shop teachers in America. One cannot possibly understand the unique place or the function of Industrial Arts in the schools today until he understands the way in which it evolved in our educational system.

Manual Training was the family name applied to school shopwork, public and private, for four decades. During this time there were various offspring with different names such as *Sloyd* in 1890, *Manual Arts* in 1900, and *Prevocational* in 1910. (These dates are approximate.) Each new arrival in the field contributed some new idea concerning objectives, subject matter, teaching procedures, and the like, but the term "manual training" seemed flexible enough to include all

¹ Committee on Research and Publications, American Vocational Association, Inc. *The School Administrator and Vocational Education*, Washington, D. C., 1950.



Mechanical Drawing at Lancaster

newcomers, even when they had such widely separated objectives as, for example, "culture and vocational proficiency," until the advent of the Smith-Hughes Law in 1917. Bennet¹ in 1917 was of the opinion, "So far as the fundamentals of handtool instruction are concerned, the main difference between good manual training and good vocational training is the amount of time and the age of the students, and not in the fundamental elements themselves."

Definition of Manual Training

Woodward wrote that "The term [Manual Training], according to the best usage, signifies the systematic study of the theory and uses of the common tools and the nature of common materials, elementary and typical processes of construction, and the execution and reading of working drawings."

Manual Training has meant virtually "all things to all men." To Runkle of the Massachusetts Institute of Technology it meant an opportunity to provide for teaching the students in the department of mechanical engineering; to Woodward of St. Louis it gave an opportunity among others for "students [to] discover their inborn capaci-

¹ Bennett, Charles A. *The Manual Arts*, Peoria, Ill., The Manual Arts Press, 1917.

ties and aptitudes"; to the students of the Boston Whittling School it was offered as "A wholesome and enjoyable work in which the students would normally engage"; to the educational leaders of the day it was looked upon as an opportunity to educate the "whole boy" (the general educational objective claimed for Industrial Arts today).

The term Manual Training has been used at one time or another to designate practically every type of Industrial Arts, Practical Arts, and Vocational Industrial work that is being taught today. The difficulty in trying to define the term lies in the fact that it was the all-inclusive name applied to school shopwork.

Definiton of Sloyd

"Sloyd" was a system of shopwork patterned after the work of Otto Solomon of Naas, Sweden, which consisted of 50 models involving 88 exercises. (*Sloyd* is a Swedish term for a whittling knife.) Otto believed that shopwork had to be interesting in order to have educational value, and, therefore, discarded the practice exercise, the keystone of the Russian system, and included the tool processes to be taught in the making of the model. He outlined four steps to guide teachers in progressing from the concrete to the abstract:

1. The students should begin to work from the model.
2. The students work from the model combined with a drawing of it.
3. The students work from the drawing only.
4. The students are allowed to plan, draw, and construct the object from their drawing.

Solomon considered interest more important than skill perfection; hence, he allowed students to proceed to a new model after two failures. He stressed the point that students must be capable of doing the work themselves without help from the teacher and thus develop independence and self-reliance.

Swedish Sloyd was adapted to fit American ideas of education by Gustaf Larson and his associates. While drawing was not considered of prime importance by Solomon, we find it an essential feature and a preliminary requirement before the student started construction in the American application of the Sloyd idea. Larson criticized the Swedish "design" and improved upon this feature in his American Sloyd models.



Woodworking at Derry Township

Manual Arts in 1900

Bollinger defines Manual Arts¹ as a term used to describe instruction in woodworking, mechanical drawing, metal work, printing, leather work, jewelry making, clay work, bookbinding, etc., "when taught as a form of general education having for its chief purpose that of developing within the student manual skill and an opportunity for the appreciation of good design and construction by practice in a variety of exercises and projects of personal value."

Manual Arts as a term came into use with the change from the emphasis upon the formal hand-skilled producing exercises to an emphasis upon the construction of articles of utilitarian value which involved the use of skill together with some freedom in design.

Manual Arts may be considered an outgrowth of the Arts and Crafts movement. It was introduced into America at Philadelphia from England by Charles Leland in 1880. Leland considered the decorative arts better suited to the age and nature of students than any of the trade or mechanical pursuits. This belief was also held by Bennett who in 1896 claimed that the student could make beautiful things at any

¹ Warner, W. E., and Others. "The Terminological Investigation." Western Arts Association Bulletin, Vol. XVI, No. 5, October, 1932, pp. 104-147.

stage of development providing he were allowed to work with tools and materials that were adapted to his ability.¹

In 1889 the Pennsylvania Commission on Industrial Education recommended the introduction of drawing and design into all manual training courses for its educational value, its importance in developing a number of faculties, its use as an important link between the school and practical industries, and its influence in cultivating better producers and more appreciative consumers. It is interesting to note the similarity of these objectives and our Industrial Arts objectives today.

Future Trends in Industrial Arts

One outstanding characteristic of the American people has been their willingness to look forward and to make preparations for the future. This characteristic has to a large extent been responsible for the progress America has made in all fields of endeavor.

Trends

It will not be attempted to describe in detail the future in the field of Industrial Arts education but to present a few of the trends as well as a few hopes and predictions in Industrial Arts education as a means of assisting educators to organize, plan, develop, and improve their Industrial Arts programs.

1. An increase exists in the number of public schools offering Industrial Arts education in the junior and senior high school programs. This increase will continue as the junior and the senior high school enrollments rise as the result of the increased birth rate of the so-called emergency years and as new school buildings are constructed.

2. More and larger units of administration will be brought about as a result of school district consolidation, which will add Industrial Arts education to their programs.

3. A number of school districts are developing curriculums in the field of Industrial Arts on the senior high school level as a means of attracting and holding more students in the senior high school for a longer period of time. The number of school districts offering this type of work will increase as the employment opportunities for people under eighteen years of age are reduced.

4. In order to meet the varied educational needs of all the students in a school system, the schools will be required to offer a curriculum

¹ Bennett, Charles A. "The Aesthetic Principle in Manual Training." N. E. A. Proceedings and Addresses, 1896, pp. 786-790.

**Welding at Derry Township**

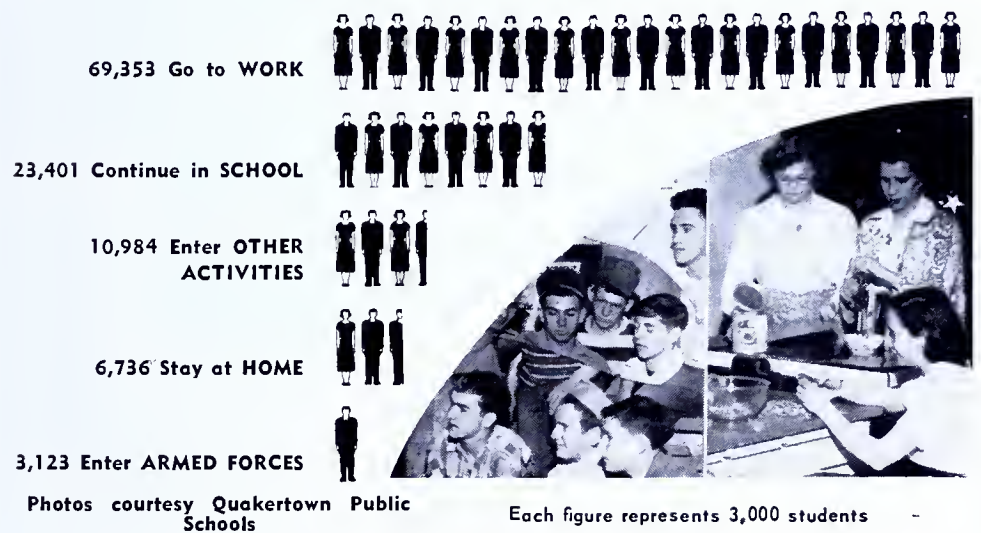
in Industrial Arts education with the several other curriculums in order to be classified as a senior high school.

5. Pennsylvania has a large number of small school districts that are in themselves too small to organize, develop, and operate a vocational industrial education program. The students from these districts, in many cases, are required to go to work upon leaving school (this applies to dropouts as well as to graduates of the high school) and in many instances have very little industrial preparation to offer for a job in industry. Many of these school districts as a result of economic necessity will offer a curriculum in Industrial Arts education which will have as one of its main objectives "to lay the foundation for entering industry" as a means of preparing students for employment and economic security.

6. Man has learned to be more efficient, and from all indications, he will become more so as time goes on, even to the point where he

will reduce his working hours. This will provide him with more leisure time. What will he do with his leisure time? This question has been asked by many school districts where employment has been

What Becomes of Pennsylvania High School Graduates and Drop Outs



reduced. It has been answered in a very small number of school districts by offering shop courses to adults during their leisure time. These courses, in many cases, are of the hobby type which can best be offered in the Industrial Arts shop by an Industrial Arts teacher. This type of program will grow as a result of changing economic and employment conditions.

7. There will be less emphasis on Industrial Arts shop techniques and more emphasis on art and design from both the producer's and consumer's point of view.

8. Industrial Arts teachers will select equipment on the basis of general principles and upon an analysis of the content of the courses which must be taught in the shop.

9. There will be less copy work in mechanical drawing and more consumer understanding and expression.

10. Proportionally fewer instruction sheets will be made by the Industrial Arts teachers and more planning sheets will be made by the students.

11. Fewer vacant Industrial Arts shop periods will be evident, and

OUR HIGH SCHOOL DROP OUT PROBLEM

Of 100.0% in the Ninth Grade



92.2% Remain in the Tenth Grade



75.8% Remain in the Eleventh Grade



Only 66.2% Remain in the Twelfth Grade



School-Work Experience Helps Keep Them In School

a greater spread of Industrial Arts education throughout all the grades will exist.

12. Girls will take Industrial Arts work as well as boys. Only in the more advanced courses will the boys and girls be segregated.

13. Industrial Arts education will make less effort to make efficient piece-work producers out of our children, and a greater emphasis will be made on consumers' education and on an intelligent appreciation of the industrial world in which we live.

14. Less noise will be made in our Industrial Arts shops through improvements in the design of equipment and shops.

15. Less emphasis will be placed on lettering, the making of inked tracings and geometrical designs in mechanical drawing, and a greater effort to teach mechanical drawing, reading, and to interpret drawings as a common and necessary language.

16. There will be fewer Industrial Arts problems or projects in the junior high school which require one or two semesters of the student's time to complete and more projects which are compatible with the interests and abilities of adolescent students.



Graphic Arts at Pittsburgh

The Educational Aspects

Place and Function of Industrial Arts in General Education Aims and Objectives in Industrial Arts

Objectives as Stated in Source Materials

Part of General Education

Present Objectives

How to Attain These Objectives

Adult Industrial Arts Education

How Industrial Arts Serves Some of the 60 Per Cent Group

Methods of Instruction

Place and Function of Industrial Arts in General Education

II. The Educational Aspects

THROUGH carefully planned and guided experiences, education should provide opportunities for students to grow and develop toward active, useful, contributing membership in a democratic society. At each school level, the educational program should be fitted to meet the needs, interests, and abilities of the students being served.

Industrial Arts education includes those experiences which are centered around the study and use of tools, materials, machines, and processes which man has adapted to serve his needs. These experiences can and should be a functioning, coordinated part of the total educational program.

As a student engages in the building or creating of an article of beauty and value, he develops the basic manipulative skills and technical knowledge needed to perform these operations successfully. In addition, however, opportunity is afforded for further growth in many of the other areas included among the fundamental objectives of education. Industrial Arts provides an approach to these objectives that differs from and is often more effective than the traditional classroom situation. Learning progresses from the concrete to the abstract. The impulses, desires, and interests of the learner are recognized and mobilized into specific "doing" experiences. The student learns as he engages actively in accomplishing ends that are meaningful to him. This concept of the learning process finds perhaps its most effective and direct application in the teaching of Industrial Arts.¹

Aims and Objectives of Industrial Arts

Industrial Arts, as now conceived, has slowly evolved over more than two centuries through the good efforts of laymen, teachers, and educators. Indeed a visit to any museum will convince one that the Industrial Arts idea antedates the historic era. This discussion is limited to aims of a comparatively recent historical period.

The purpose of the next few paragraphs is to trace the movement briefly through two and one-half centuries; to show that practically

¹ California State Department of Education, *Guide for Industrial Arts Education in California*. Vol. XVIII, No. 7, September, 1949.

every aim that we ascribe to Industrial Arts today was stated by some educator long before our generation; and that while the name Industrial Arts was not generally applied to nonvocational school shopwork before 1920 the idea itself is based on centuries of progressive educational practices.

Objectives as Stated in Source Materials

Provision for Occupation

1592-1670. *Comenius*: "Boys ever delight in being occupied in something, for their youthful blood does not allow them to be at rest. Now as this is very useful, it ought not to be restrained, but *provision made* that they may always have something to do. Let them be like ants, continually occupied doing something, carrying, drawing, constructing, and transporting, provided always that whatever they do be done prudently."¹

Provision for Leisure Hours

1871. *Boston Whittling School*: "The value of such a school is not so much in the amount of skill the boys attain to, but in the bent it gives their tastes, and in the innocent enjoyment it gives to their *leisure hours*."

Inclination for Handicraft

1874. *Cheney*: "It was not designed to make finished workmen in wood-carving, but to take advantage of the natural inclination towards handicraft—the Yankee taste for whittling which belongs to most boys, and to develop it and guide it to useful application."

Secondary Education

1878. *Woodward*: With the establishment of the Manual Training School under the leadership of Woodward the manual training school "movement was given its American name, form, and significance as a means of *general secondary education*."

Tools and Materials

1896. *Bennett*: Bennett claimed that the child could make beautiful things at any stage of development, providing he were allowed to work with *tools and materials* that were adapted to his ability.

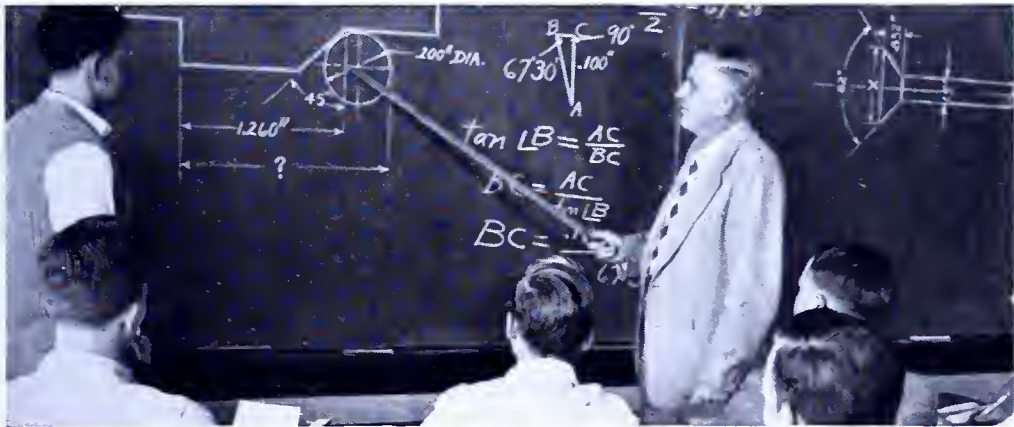
¹ Griffith, Ira S. *Teaching Manual and Industrial Arts*. Peoria, Ill.: The Manual Arts Press, 1924, 259 pp.



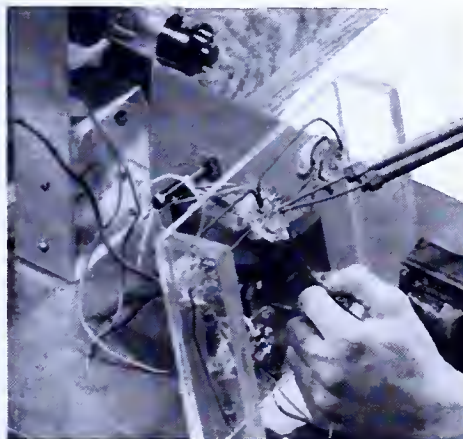
1592—Comenius: Boys ever delight in being occupied with something.



1871—Objective of
Enjoyment of leisure hours.



1949—Guide for Industrial Education in California: Grow and develop toward active, useful, contributing membership in a democratic society.



1874—Cheney: Natural inclination for handicraft.

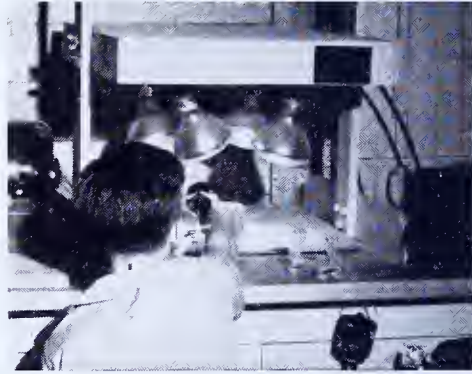


1878—Woodward: Significance in general secondary education.

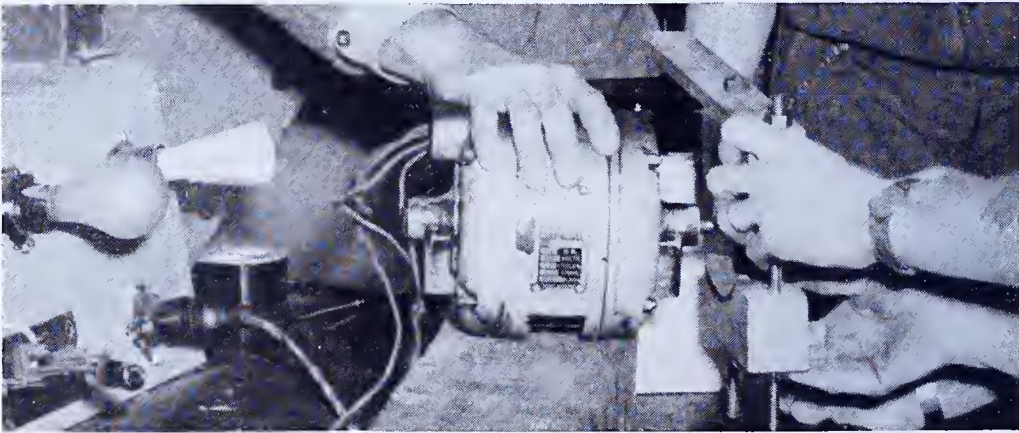
Photos courtesy Shamokin, Altoona, Williamsport, Pittsburgh and Hershey Public Schools



1896—Bennett: Work with tools and materials.



1909—Russell: Afford motor expression.



1939—Pennsylvania Department of Public Instruction: Industrial Arts mandated for all junior high schools.



1910—Richards: Element of culture and general efficiency.



1937—Office of Education: General values that apply to all levels

Photos courtesy Shamokin, Quakertown, Lebanon, Erie and Coatesville Public Schools

Provision for Expression

1909. *Russell*: Subtract from our present manual training course that which is essentially applied design and those exercises which are intended to *afford motor expression* in the learning of other subjects in the curriculum, and what is left is an incoherent, unorganized series of projects without purposes or educational values.

Cultural Value

1910. *Richards*: The first serious agitation for the inclusion of industrial education in the public schools was, naturally enough, when the prevalent attitude of the schoolmen was considered not for real vocational training, but for the inclusion of manual work in the general course of study as an *element of culture and general efficiency*.¹

1912. *Leavitt*: The result of this discussion was to establish the claim that *Manual Training has a distinct cultural value*, and it was because of general acceptance of this proposition by educators that the new form of educational activity was so speedily and generally established.²

Part of General Education

The most significant thread in the history of shopwork in Europe and America emphasizes the fact that Industrial Arts is a part of general education. It is not generally realized that almost from the beginning of school shopwork it has been given a general education objective.

In addition to the aims to which Industrial Arts fell heir, modern educational theory and practice have pointed to other and equally important objectives in this field.

Present Objectives

Today Industrial Arts aims to develop in each student

1. An active interest in industrial life and in methods of production and distribution. (*Guidance values, general information, better social understanding, working conditions, sanitation.*)
2. The ability to select, care for, and use properly the things a student buys or uses. (*This is sometimes referred to in less specific terms as consumer knowledge.*)

¹ Richards, Charles R. *Some Notes on the History of Industrial Education in the United States*. N. E. A. Proceedings and Addresses, 1910, pp. 675-680.

² Leavitt, Frank M. *Examples of Industrial Education*. Boston: Ginn and Company, 1912, 330 pp.

**"Interest in
industrial life
and methods"**



**"Ability to
select, care
for and use
... things"**



**"Appreciation
of good
workmanship
and design"**



**"Pride in
abilities to
do something
useful ..."**



Photos courtesy Altoona, Erie, Cootesville, Quakertown Public Schools



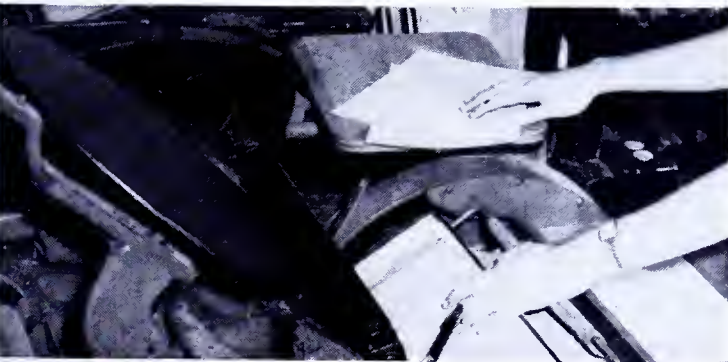
**"Develop . . .
habit of self-
discipline"**



**"Develop . . .
habit of
orderly . . .
performance"**



**"Develop . . .
feeling of self-
reliance and
confidence"**



**"Develop
elementary
skills in the
use of . . . tools"**

Photos courtesy Altoona, Easton, Coatesville, Quakertown Public Schools

3. An appreciation of good workmanship and good design. (*Aesthetic values, consumer knowledge.*)
4. An attitude of pride or interest in his ability to do useful things. (*Self-respect, worthy home membership.*)
5. A feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation. (*Self-confidence, initiative, forcefulness, aggressiveness, leadership, judgment.*)
6. The habit of orderly procedure in the performance of any task. (*Efficiency, purposeful activity, planning ability.*)
7. The habit of self-discipline which requires one to do a thing when it should be done, whether it is a pleasant task or not. (*Reliability, idealism, obedience to authority.*)
8. The habit of careful, thoughtful work without loitering or wasting time. (*Industry, usefulness, productivity, planning.*)
9. An attitude of readiness to assist others when they need help and to join in group undertakings. (*Cooperation, unselfishness, getting along with people.*)
10. A thoughtful attitude in the matter of making things easy and pleasant for others, and in conforming to social customs. (*Consideration for others, courtesy, refinement, good citizenship.*)
11. Desirable attitudes and practices with respect to health and safety. (*Health and safety habits.*)
12. A knowledge and understanding of mechanical drawing, the interpretation of the conventions used in drawings and working diagrams, and the ability to express his ideas by means of a drawing. (*Skill in rendering and understanding of drawings.*)
13. Elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man, together with a knowledge of the working qualities and characteristics of some of our most-used materials. (*Tool skills, procedures, principles of machine operation, and construction practices.*)

It will be observed that some of these objectives deal with skills, information, and principles which are matters of direct instruction;

others deal with interests, attitudes, habits, and character traits which are regarded as the attributes of the good and useful citizen. The latter are acquired through the methods of procedure in learning the former and through their interpretation and their application in the solution of problems.

The limit of the number of things set up as matters of direct instruction may be rather definitely fixed, as they deal with specific subject matter; the number of desirable habits and attitudes which may be developed while acquiring the subject matter are almost without limit.

If any teacher should desire to change or add to this list of objectives, he should feel free to do so. The only restriction should be that he provide a definite place in his teaching plan for doing the thing which he sets up as his objective. It is not sufficient to say it may be done; he should indicate how he will do it.

How to Attain These Objectives ¹

In connection with each of the stated objectives, a number of suggestions follow as to how the objective may be realized. It is not expected that all of the means suggested will be used. The resourceful teacher will find many other ways, some of which may be more effective.

Objective 1. To develop in each student an active interest in industrial life and in methods of production and distribution.

This wholesome interest in people, their occupations, and in the material things about one is of distinct guidance value to a boy and will add to his pleasure and usefulness. Active interest in industrial life and vocations probably is the most important single guidance factor. The development of these interests does not necessarily involve shop-work, but such work often provides an excellent opportunity to promote them.

The following headings represent the types of learning units dealing with information which it is believed will contribute to this objective. Under each heading should be placed the particular units which appear to be best adapted to the local situation. The purpose expressed in the objective must be kept constantly in mind. The material presented should not be of a highly technical character, but should be of such a nature as to arouse interest in industries and industrial life.

¹ State of Missouri, State Superintendent of Public Schools, *Practical Arts: Industrial Arts Handbook*, 1941, pp. 17-28.

a. How Things are Made.

This may include two types of problems, one type dealing with familiar articles which are manufactured in distant communities. In this group might come such things as pencils, paper, glass, nails, asbestos, pipe, cement, clothing, hats, copper, coal, oil, gas, depending upon location. This material may be presented through the following means:

Industrial exhibits from various manufacturing concerns showing processes of manufacturing.

Attendance at commercial exhibits, lectures, expositions, etc.

Organized talks by teacher on how things are made.

Reading from references concerning manufacturing processes.

The use of films and slides.

Through inquiry to manufacturers concerning the manufacture of their particular products.

Other types of problems may deal with local industries, such as how any or all of the following articles are produced and distributed: ice, bread, butter, ice cream, flour, gas, water, electric current, newspapers, or any of the other services of the community. The difference between these two groups lies mainly in the method of procedure in getting the information. In the latter group the following means may be employed to secure information and arouse interest:

Visit industries of the city with the purpose of learning the processes of manufacture and the conditions of employment.

Invite workers, foremen, or managers of concerns to talk to students concerning the industry.

Observe current construction jobs.

b. Sources of Raw Materials and the Methods of Transporting and Using Them.

These problems should be presented in such a way as to arouse a wide interest in transportation, occupations of people in distant communities, and the specific problems of handling and caring for the materials studied. Some of the following means may be employed for this purpose:

The use of commodity and product maps.

Reports made on the basis of assignment sheets supplied by the instructor.

Exhibits showing sources of raw materials.

Information concerning the transportation of raw materials, which may be secured through the education departments of railroad companies.

State reports and maps showing location and sources of important raw materials, such as iron, copper, coal, lumber, oil, etc.

Distribution of local products, the problems, and kind of work involved.

c. Methods of Distribution of Articles.

Invite a grocer or some other merchant to talk to the class on how and where articles are produced and brought to his store.

Observe methods used by various companies for distribution of their wares, such as automobiles, gasoline, milk, trucks, bakery goods, etc.

Study the distribution of local products, the problems and kind of work involved.

d. Working Qualities and Durability of Manufactured Articles.

Make test in shop where it is possible for the boys to make sales talks with some basis for their assertions.

Let the class members give their opinions on qualities of articles they have in their homes.

Study methods of making articles more durable and the problems involved.

e. Commercial Sizes, Grades, and Classifications of Sales Units.

Exhibits.

Visiting retail stores and window shopping.

The study of price lists and catalogs.

Filling in order blanks.

f. Working Conditions, Requirements, and Opportunities in Various Types of Industries.

A visit to the industry to observe working conditions.

A study of the wage scales of workers.

Figures concerning the stability of employment in industry.

A study of the educational qualifications of workers.

A study of the opportunity for advancement.

Objective 2. To develop in each student the ability to select, care for, and use properly the things he buys or uses.

The purpose should be to establish a careful, thoughtful attitude in order to avoid waste, and to secure the greatest possible service from the things we buy and use.

In connection with such training, we should emphasize the points to be considered in making the choice of articles and in their care and use. Some of the principal points to be considered may be stated as follows:

a. Conditions in Use.

Discuss the importance of considering the conditions under which an article is to be used before it is purchased. This should include such things as climatic conditions, moisture, heat, cold, and rough or careless use, as they would affect the life and usefulness of the article. Have the students give examples of damage to articles, due to use under unfavorable conditions, and consider means of protection and the choice of articles with qualities better fitted to meet these requirements.

b. Qualities Necessary for Satisfaction.

Is the article durable for the purpose to which it will be put? Will it be used for the purpose and in the manner for which the manufacturer intended it? Is it pleasing in appearance? Is it in style? Make a list of the qualities which are desirable in various products, such as clothing, shoes, refrigerators, furniture, tools, etc.

c. Cost.

Compare quality and cost of various articles, such as tools, supplies, and things used in the home, and determine, if possible, the reason for the difference in cost of similar articles.

Compare quantity and small lot buying as to saving in cost, spoilage, waste, and extravagance in use.

d. Use of the Articles for the Purpose and in the Manner Intended.

Emphasize the fact that most articles will give reasonable service when used for the purpose and in the manner intended.

Emphasize that when a machine does not operate properly it usually is out of adjustment, and that it should not be operated until the difficulty is located and the adjustment made.

Never force a machine. Let students cite instances where articles have been damaged by being used for purposes or in a manner for which they were not intended.

Make a list of bad habits in the use of articles which students have observed in the shop and elsewhere.

Have students give examples of breakage, damage, or excessive wear of articles outside of school due to improper use or lack of proper care.

e. Protection from Wear and Damage.

Study the preservation of surfaces by painting and finishing.

Study the effect of oils and grease as lubricants.

Discuss methods of protecting materials from rust or corrosion.

f. Importance of Making Necessary Repairs and Adjustments Promptly.

Make repairs of home articles in the shop.

Point out the damage and destruction of furniture due to failure to keep the joints tight.

Stress importance of keeping up repairs about the home in order to prevent damage, citing the old adage—"A stitch in time saves nine."

Discuss accidents due to improper adjustments and repair of tools and equipment, or lack of proper upkeep of things about the house.

g. The Proper Care of an Article when in Use.

Study the manufacturer's directions for the use of various tools, instruments, and machines.

Discuss importance of regular and systematic oiling of machines.

Objective 3. To develop in each student the appreciation of good workmanship and good design.

Valid judgments with respect to design can be developed only through a knowledge of the principles of design and an opportunity to observe and compare the application of these principles in many situations. The design of articles made in school shops may be of a very high order, but they are not sufficient in number to give an adequate basis for the appreciation of good design. There must be a wide observation in order to give an adequate basis for generalization.

Compare articles of recognized superior workmanship with those of inferior workmanship.

Have displays of workmanship judged by the teacher and the class to be of good quality and good design.

Study displays of these articles and compare their qualities with design and workmanship.

Visit museums and compare the workmanship and design with similar modern articles, such as clothing, furniture.

Study old and new catalogs and compare designs of articles.

Compare old and new construction methods, such as peg joints versus glue, nails, and screws, handwork and machine work.

Consider the effect of style and fads on design.

Have students prepare cards, showing good and bad types of design, for various types of articles.

Objective 4. To develop in each student an attitude of pride or interest in his ability to do useful things.

Pride in one's ability to do useful things is one of the best guarantees of good citizenship. It can be acquired only through successful accomplishment, and every student should be trained until he can do well at least a few things. This avenue to self-respect should not be neglected. One likes to do the things he does well, and a distasteful task in learning may become a pleasure in accomplishment. In order to develop this attitude, good workmanship must be required. No one with right ideas with respect to standards can take pride in careless and slovenly work.

a. Services Performed in the Home.

Responsibility for certain duties about the house, such as keeping a room in order, looking after the heating, making small repairs, keeping on the lookout for and removing fire hazards.

b. Services Performed for the School.

Participate in safety campaigns to eliminate hazards in the school.

Aid in making trophy cases, bulletin boards, and other useful things about the school.

c. Services Performed for Student.

Prolong the usefulness of articles by repairs, such as bicycles, books, skates.
Make things which he wants to use instead of buying them.

d. Services Performed for Other Individuals.

Repair of toys preceding Christmas.
Make things for members of the family at home.
Make things which will be useful to friends.

e. Any Services which Suggest Superiority of Accomplishment.

Use merit badges, honor rolls, progress charts, to encourage accomplishment.
Reward good workmanship by display of projects.
Give public recognition to exceptionally good work by having students appear on an assembly program.

Objective 5. To develop in each student a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation.

a. Familiarity with Machines and How They Operate.

Have students actually operate machines.
Assign responsibility for individual care of machines.
Study machines to compare methods of operation.
Study working drawing of machines, and how to make minor adjustments and repairs on machines in the shop.
Study oiling charts.
Study how lines of power are carried through machines, and how different kinds of movements are produced.

b. The Ability to Use Our Common Tools and Materials Sufficiently Well to Meet Emergencies.

Offer a series of projects that will include all of the common tools or operations.
Teach the characteristics of the various materials with which the class works, such as wood, metal, finishes.
Let students list similar projects which involve the same processes as were used in their last project.
Have the class make some simple projects with tools limited to the barest necessities, making it necessary to do some improvising to get the job done.
Require the students to make projects requiring the use of the less familiar tools, such as a spokeshave.

c. Establishing the Habit of Examining a Problem to See What is Required before Beginning on It.

Require a job plan for every job.
Have student make job plans for work done at home.

d. Transacting Business.

Have students make the arrangements for visits to trade centers or industries.
Make out sample orders and keep records in the shop.
Let students buy, under guidance, the supplies they use at home.

e. Meeting People in Social and Business Intercourse.

Assign students to act as guides and hosts for visitors who might come to visit the shop.

Take field trips to study the characteristics of some occupation.

Participate in assembly program.

f. Foremanship Organization.

Organize class with group foreman.

Objective 6. To develop in each student the habit of an orderly method of procedure in the performance of any task.

This habit of work is so important that, in order to establish it, we should make it a conscious part of every school task. If this habit can be established in school and carried over into outside work, a service of inestimable value to the youth will have been performed, whatever may be his vocation.

This may be developed by:

Requiring a careful examination of all jobs, tasks, or assignments before beginning on them in order to find out just what is required.

Requiring a definite step by step plan for doing the job.

Requiring tools, materials, and supplies to be kept in an orderly manner while working.

Requiring each student to survey his working position, tools, and materials before he leaves to see that they are in order.

Objective 7. To develop in each student the habit of self-discipline which requires one to do a thing when it should be done, whether it is a pleasant task or not.

Unfortunately our educational theories have been so interpreted as to discourage the development of this trait. The idea of permitting the spontaneous interest of the child to determine what he shall learn or what he shall do destroys the fiber from which men are made. The self-denial and self-discipline which requires one to do a thing which should be done, whether it is pleasant to do it or not, is the very essence of civilization. It should be held up as an ideal.

Teachers may contribute toward this by requiring boys to complete the tasks they undertake, even though they become tired of them, and by arranging things so they cannot escape certain duties. Using unpleasant tasks as a means of punishment destroys their value for self-discipline.

- a. Assign a Student a Task or Duty and Arrange the Assignments So He Cannot Escape the Responsibility for Doing It. They may include:*

- Cleaning the finishing room sink.
- Keeping his tools sharp.
- Cleaning and oiling the machines.
- Making a plan of procedure and following it.
- Putting the stock room in order.
- Keeping tools and equipment in their proper places.
- Cleaning paint brushes.
- Helping others get stock.
- Sweeping the floor.

- b. Require a Student to Complete Every Job or Task That He Has Started or Has Been Assigned.*

Teacher should be careful not to assign jobs or tasks that are beyond the ability of the student.

No student should be allowed to quit a job just because he has lost interest or is tired of it.

Set a time limit for all jobs; do not allow procrastination.

Give credit on a progress chart.

Arrange a schedule of duties and have students volunteer for jobs.

Teacher can help to develop this attitude by setting a good example.

Develop the habit by creating satisfaction in performance.

Explain the reason for the job.

Set up a personnel organization for rotation of tasks among students.

Recognize accomplishment.

Objective 8. To develop in each student the habit of careful, thoughtful work without loitering or wasting time.

The teacher should, when assigning a task, make clear the objective to be accomplished. Specifications should be complete and accurate.

Require a step by step plan of procedure and require the student to follow it. Show advantages of such a plan of procedure. Set up time limits for jobs in consultation with student. Make completion schedule for different parts of the job.

Teacher should have a large supply of well-organized jobs available so as to eliminate waste of time between jobs.

Provide projects which are of interest to the student.

Provide good physical surroundings:

- Good light, heat, ventilation, etc.

- Proper tools, equipment, and materials.

- Effective arrangement of equipment.

Promote good personnel organization among students.

Check student as he progresses on the job.

See that each individual works up to the limit of his capacity.

Objective 9. To develop in each student an attitude of readiness to assist others when they need help and to join in group undertakings.

a. Help from Others, or Helping Others.

- Gluings up a project.
- Removing chuck from lathe.
- Cutting long barstock.
- Making blueprints.
- Helping others carry large projects.

b. Group Cooperation.

- Making stage scenery.
- Making athletic equipment.
- Observing safety regulations.
- Keeping shop in order and tools in place.
- Taking turns when there is a tool shortage.
- Assembly programs.
- Club programs.
- Shop foremanship organization.
- Aiding charitable organizations.
- Doing jobs for other departments.
- Teacher sets a good example.

Objective 10. To develop in each student a thoughtful attitude in the matter of making things easy and pleasant for others, and in conforming to social customs.

This would involve such matters as keeping things in order, putting tools away in good condition, and always doing a full share of the work where others are involved. It may also include doing things for the home with a view of contributing to a happy and pleasant home life. It is necessary that such experiences be associated with the idea of consideration for others. If they are done only because of the rules they lose their value for the purpose of developing this attitude. In doing things for the home or for others emphasis should be placed upon the pleasure it will give as well as the usefulness of the act.

- Keeping tools and equipment in good condition contributes toward making things easy and pleasant for others.
- Doing these things constitutes the Boy Scout's daily good turn.
- It is an evidence of politeness and good breeding.
- It is one of the surest ways of securing consideration from others.

Objective 11. To develop in each student desirable attitudes and practices with respect to health and safety.

The experiences in the field of Industrial Arts offer exceptional opportunities to provide information about and establish habits of health and safety.

Impress upon all students the importance of physical care which in any way affects their health.

Be sure that they are familiar with the common health rules and that they practice them.

Develop safety consciousness by having students make note of and report various hazards about the school, in the home, or on the streets.

Keep posted a record of accidents, with causes if possible, reported in the newspapers.

Have safety rules with respect to tools, machines, and conduct.

Provide first aid.

Objective 12. To develop in each student a knowledge and understanding of mechanical drawing, the interpretation of the conventions used in drawings and working diagrams, and the ability to express ideas by means of a drawing.

This represents a knowledge and understanding as well as skill. If the experiences in this field are carefully planned and well organized, they may form the basis for the development of a number of other objectives.

The experiences should include:

Reading working-drawings.

Reading diagrams, charts, and maps.

Reading house plans.

Making working-sketches.

Making tracings.

Making working-drawings.

Making blueprints.

Objective 13. To develop in each student elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man, together with a knowledge of the working qualities and characteristics of some of our most-used materials.

a. General Skills and Procedure.

This involves the fundamental idea of the general shop where practice is given in a great variety of low-skilled processes of frequent occurrence in the lives of most men. Such skills are not based upon the usual trade or industrial divisions.

The training should begin with the tools and materials most frequently used, and extend as far as the particular situation appears to demand and time will permit. In the case of those tools less frequently used, an experience sufficient to give a clear understanding of how the processes are performed is adequate for most purposes, as skills may be developed through practice when occasion for their use arises.

The ability to perform the rather unspecialized mechanical duties of the vast majority of men does not depend so much upon a highly developed skill as upon a knowledge of the qualities and characteristics of materials in common use, the methods of modifying and handling them, a knowledge of some of the most-used principles of construction, an understanding of the principles upon which machines operate, and some of the rather elementary skills in the use of common tools.



"Provide an understanding of and a measure of control over the man-made physical world." "Fuller self-realization is gained in knowl-



edge of one's capacities, feelings and attitudes." "All . . . secured through an insight into the way goods are produced . . ."



Photos courtesy Altoona and Coatesville Public Schools

b. Skills, Information, and Procedure Based Upon the Usual Vocational and Industrial Groupings.

This involves the development of groups of related skills and approaches the vocational in character. It will require more extensive experience and greater practice in the particular group. To develop a feeling of ease and mastery in the use of tools requires practice with them until one can use them with pleasure and satisfaction. No one can feel at ease when handling unfamiliar tools and materials or when working in an unfamiliar situation.

c. Leisure-Time Activities.

Leisure-time activities are based upon skills and no one will long continue a voluntary activity unless he gets out of it the satisfaction of work well done. The surest way of encouraging such activities is to encourage the development of a degree of skill which will give pride in accomplishment.

Adult Industrial Arts Education

Probably no area of the secondary education program lends itself better to recreational and avocational interests of adults (both men and women) of the community than does Industrial Arts. Industrial Arts is especially appealing because the available facilities, under proper supervision of the instructor, transform the school shop into a well-equipped home workshop. A program of informal instruction for adults can contribute immeasurably toward kindling wholesome and active interest in the school, as well as providing an excellent type of productive recreation.

Interests Vary

Generally, the program should be informal. Formal instructional programs have less appeal in most communities, as the abilities and interests of the participating adults will vary greatly. Adult programs should be established with the teacher serving as supervisor and consultant to those well able to proceed with work of their choice while devoting the major portion of his time to the needs of those with little or no experience.

Costs are at Minimum

Inasmuch as facilities already exist, the financial burden on the school district may be quite nominal. Instructional costs are at a minimum since salaries of teachers are generously reimbursed through state funds. The adults participating in the program may be expected to pay for raw materials involved in projects which they take home for personal use.



Sheet Metal at Pittsburgh

The expense incurred for partial salary payment, plant and equipment overhead is well compensated by the resultant good will among those who, over a period of years, find themselves brought into more intimate contact with their schools through a program of Industrial Arts.

How Industrial Arts Serves Some of the 60 Per Cent Group

The Prosser Resolution and resultant national and state groups expanding upon that Resolution have identified the educational needs of the majority of upper secondary students for life adjustment. While the learning areas have been more clearly defined, the identity of students coming under the Resolution is now and will remain the problem of each local school.

Who are the "60 Per Cent Group"?

The upper secondary school functions for three distinctive groupings of individuals. Each of these groupings should have *equal recognition and educational provision in the program*:



20% Take
College
Entrance
Courses



60% Need Exploration, Counseling, Self-Appraisal
and General Education



20% Take
Vocational
Education
Courses

Photos courtesy Coatesville and Quokertown Public Schools

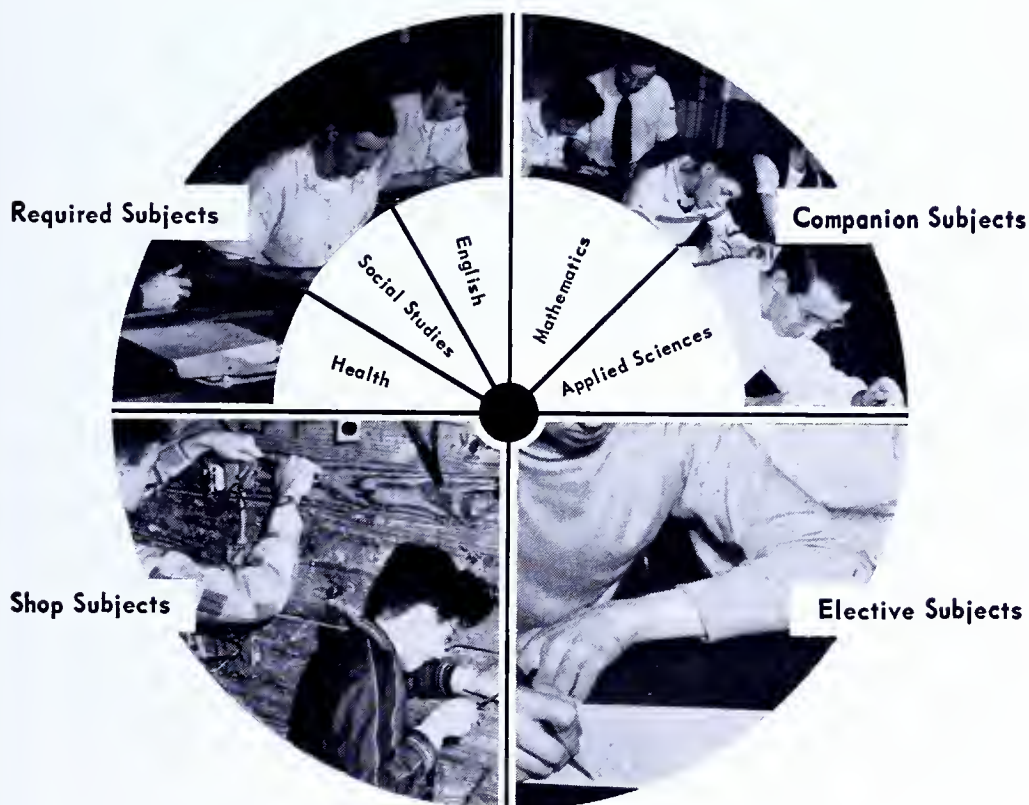
1. Approximately 20 per cent of all secondary students are pursuing educational programs designed for college entrance.
2. Another 20 per cent are pursuing some form of Vocational Education with the intent of entering employment or homemaking upon graduation.
3. Fully 60 per cent vainly seek the exit from the educational maze to which they have been committed. This group requires help through exploration, counseling, self-appraisal, and general education. At the same time their program of studies must prepare them for the realities of job placement and adulthood.

Redesign for Effective Participation

The Industrial Arts Program has a major responsibility in this area of adjustment. This responsibility requires a redesigning of the program to participate effectively with the school as a whole in the adjustment of upper secondary students.

1. Industrial Arts facilities must be broadened to offer the widest possible opportunity for exploration of work processes and industrial materials.
2. Projects as the vehicles of learning should be more complex and challenging, involving investigation, inquiry, and experimentation.

*"Shop work, mathematics and applied science, 50%.
Required subjects, of English, Social Studies and
Health, 25%. Elective subjects, 25%."*



3. The teachers must plan for inclusion of occupational information, studies in self-appraisal and more intimate knowledge of the worker skills of the community, as part of Industrial Arts instruction.

4. The teacher must plan for instruction in desirable worker attitudes, such as respect for property rights, employer-employee relations, the right of collective bargaining, the conservation of time and materials, and the need for thoroughness and detail.

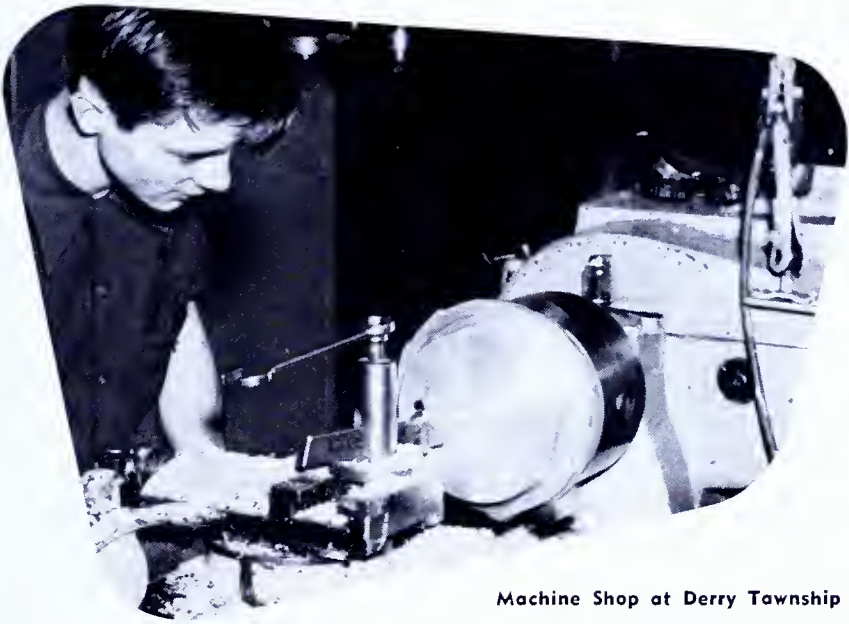
Methods of Instruction

All of these things cannot be left to chance learning as concomitant to shop instruction. Required are relatively short periods of discussion, small group conferences, special assignments for service or information in the school or in the community. Planning by the group or

by the teachers purposing to live through a situation will result in adjustment thinking for the group or for an individual. Purposing and planning are the keynotes to effective instruction.

Enrichment of the Industrial Arts program along the foregoing pattern will require additional scheduled instruction time. It should not be attempted where groups are scheduled for single periods several times a week. When time is so limited pupil enthusiasm to work in the shop would defeat the broader purposes of the program enrichment. Neither would a scheduled classroom period with the shop teacher for group instruction properly integrate the learnings. The procedure, to be most effective, must grow with or out of the shop activity. Frequently, the teacher must deal directly with the individual or a small group in an unnoticed, unobtrusive way, while all other students are continuously engaged in their shopwork. This cannot be done under group classroom conditions. An ideal situation could result from scheduling individual conferences a solid half day, one or more times per week, or by scheduling such conferences for double periods three or more times per week.

It is useless to look upon this reorganization of the Industrial Arts program as an experiment to be approached with scientific exactness and psychological controls; the best Industrial Arts teachers have always used these techniques. The results from such improved instruction and organization will be quickly apparent to the school and community in satisfaction to the student and parents.



Machine Shop at Derry Township

The Curricular Aspects

Industrial Arts and Subject Intercorrelations

Location and Delineation of the Problem

Purposes Behind Organization of the "Merged Core"

Idea of "Core" in Academic Subjects and the Arts

Core Curriculum in Junior High Schools

Correlations in Natural Situations

The Industrial Arts Program

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III. The Curricular Aspects

Location and Delineation of the Problem

UNDER the term *core curriculum* are included such similar or related terms as "merged course work," "related content," "integration," and "correlation." Generally core curriculum is restricted in application to junior and senior high schools. In its organization it attempts to vitalize education by cutting across subject boundaries. It is supposedly limited to the basic aspects of life and society that are considered essential to the education of every American youth. It should be limited rightfully, therefore, to the common learning, not to specialized courses. This factor removes its application from Industrial Arts in senior high schools.

If, on the other hand, the core curriculum is applied to the six-year elementary school, any handwork which is desirable or essential in group projects rightfully becomes part of the merged experience of creating such a project.

Purposes Behind the Organization of a Merged Core

Specialization in subject-matter teaching has increased because of

1. Great increases in human knowledge
2. Scientific developments in human and exact sciences
3. Large classes
4. Social-democratic reasons

On the other hand, *core curriculum*, *correlation*, *integration*, and *merging* have more lately come into being because

1. A social counterbalance was needed to extreme specialization in courses, and curriculums.
2. There is realization that neither extreme specialists nor generalists make the best citizens for a democracy. Successful living includes both.

The Idea of Core in Academic Subjects and the Arts

Academic subjects are largely based upon controlled learning while the arts (practical and fine) use in a larger measure an expressive, self-directive type of learning experience. Good Industrial Arts has

consistently used the philosophy of core or merging in the organization and teaching of its course materials.

Core Curriculum and Industrial Arts in Junior High Schools

In the seventh, eighth, and ninth grades Practical Arts are required, and it is here that Industrial Arts serves the greatest number and is of interest as a vitalizing factor in life and education for the largest percentage of students. Where Industrial Arts is well organized and taught it is a core in itself. Different areas of general shops are tied together. The work in several shops, if there are more than one, the design, planning, and art are related. Correlations are made with some aspects of physical and biological sciences, and also through informative content with certain phases of industrial economics, history, social problems, and occupational selection. Excellent reciprocal correlations are natural. These are complete educative experiences: thoughts, words, symbols, and objects.

Little evidence exists of success in recorded results of attempts to include Industrial Arts in core curriculum of junior high schools, even of special schools of the experimental and so-called progressive types. There is evidence that some of the rather unusual and almost unique educational experiences, and otherwise unachievable aims derived from well-organized and well-taught Industrial Arts are lost when it is merged with totally different types of learning (seeing, hearing, reading, memorizing.)

Correlation on Natural Situations

On the basis of present developments Industrial Arts will function most effectively for large numbers of junior high school youth if it seeks, plans for, and *correlates* its work on definite schedules wherever natural situations exist such as:

1. Within Industrial Arts courses:

- Shopwork of various types.

- Related guidance, consumer and technical information.

- Planning and plan reading.

- Individual and group projects.

2. Between different Industrial Arts and drawing or plan-reading courses:

- All under Item 1, but extended to all activities in the several shops of the school



Sheet Metal at Pittsburgh

3. Reciprocally between Industrial Arts courses and certain phases of academic instruction and other student services:

With art and design

With other practical arts as home economics

With certain phases of chemistry, physics, and botany

With English and dramatics

With some extracurricular activities

With the school-wide guidance program

With certain phases of the social studies or problems of an industrial democracy

All of the above types of planned and scheduled intercorrelations of Industrial Arts and other education activities can be done successfully in the junior high school grades.

"Industrial Arts . . . has general values that apply to all levels . . ."



Photos courtesy Erie, Coatesville and Quakertown Public Schools

The Industrial Arts Program

A Program is Essential

The Prosser Resolution and resultant emphasis on Life Adjustment Education has revitalized the content and contribution of Industrial Arts instruction. A school should not be content with having a shop course left largely to the judgment of the shop teacher. A definite program should be planned for groups of boys and girls, and frequently for individuals in the school to whom the shop teacher may become a special tutor.

To do an effective job in this regard, the shop teacher should have an advisory committee of other staff members to confer with him regarding the details of his program and his plans for a vital educational service.

The program will differ in major aspects with the grade level of the school organization. Such emphasis is indicated in the following breakdown.

The Program for Grades 4 to 6

Shopwork at this age level is properly termed *Arts and Crafts*. Materials are of a nature that require simple hand tools. Projects can be

completed in each class session. The activities are confined to basic learnings in tools, materials, and processes. There is little freedom of project choice. The desire for physical activity and the novelty of the workshop atmosphere are compelling motives requiring energy and resourcefulness on the part of the teacher. Occasionally there are over-age or problem students to be accommodated by the teacher. Special projects, tools, and materials may be required to meet the planning and performance level of such students.

The Program for Grades 7 to 9

During these grades Industrial Arts is a required course for all boys and an elective for girls under an approved junior high school classification. The keynote of the program is exploration of likes and dislikes, discovering of aptitudes, an investigation of tools, materials, and processes of our contemporary industrial society. Basic learnings give way to individual initiative in selection of projects or, at times, group cooperation in some worthy school or community objective.

The plan of the program aims at fulfilling the objectives of Industrial Arts through individual work, group projects, planned visitations, visual aids, and other means at the disposal of the teacher. To have a plan, to work the plan, and to report on the success of the plan for the year, is an essential duty of the teacher.

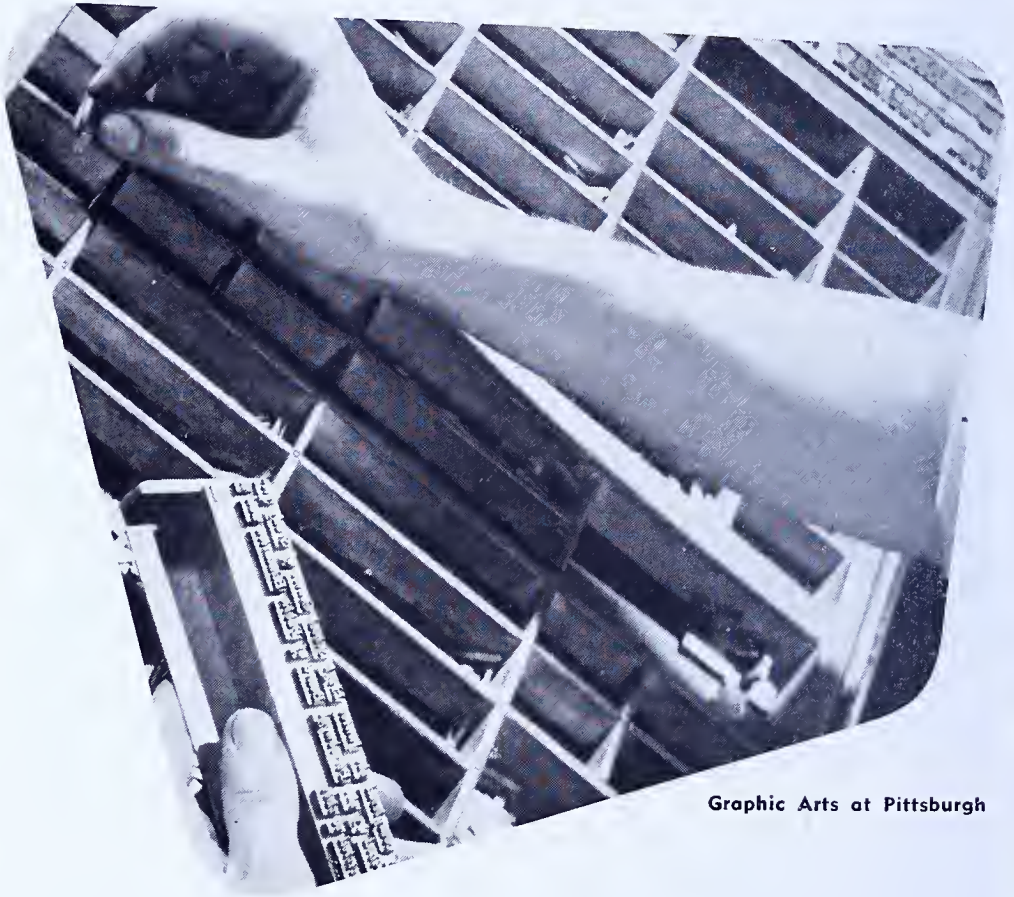
The Program for Grades 10 to 12

Boys and girls during these years are pursuing high school courses leading to various objectives. During this time the shop teacher should consider presenting his work in light of the needs of the student and his subject objectives. To the college preparatory student, Industrial Arts should emphasize leisure-time activities, breadth of life interest, and a supplemental activity to normal school work. To the general curriculum student it may continue to be exploration and frequently preparation for employment or part-time work experience.

In any event, the shop teacher should have a planned program to meet varying objectives. When vocational industrial curriculums are not provided, or readily available, there is a need for planning the Industrial Arts Program on an Industrial Arts Curriculum pattern.

The Industrial Arts Curriculum

The curriculum should be planned with emphasis on shopwork and supplemental subjects. Fifty per cent of scheduled time to be devoted

**Graphic Arts at Pittsburgh**

to one shop, or rather a succession of different shops, plus majors in mathematics and laboratory science. The remaining 50 per cent of scheduled time to be devoted to the general education subjects and electives.

Students from such a curriculum might be preparing for college, particularly for institutions of a technical or scientific nature, but in the main, their objective will be employment upon graduation from the secondary school. All instruction in supplemental and general education subjects should be as practical and objective as possible. Principles must be taught as thoroughly as in any other curriculum, but application and assignment should be in terms of real life situations and problems.

Each school district will develop its own particular Industrial Arts Curriculum on the basis of facilities, community interests, and pupil

needs. An advisory committee composed of staff and laymen could well be utilized to inspect the proposal and observe the program in action. It may be that work-experience could be a part of the program with appropriate supervision and credit for worthy performance.

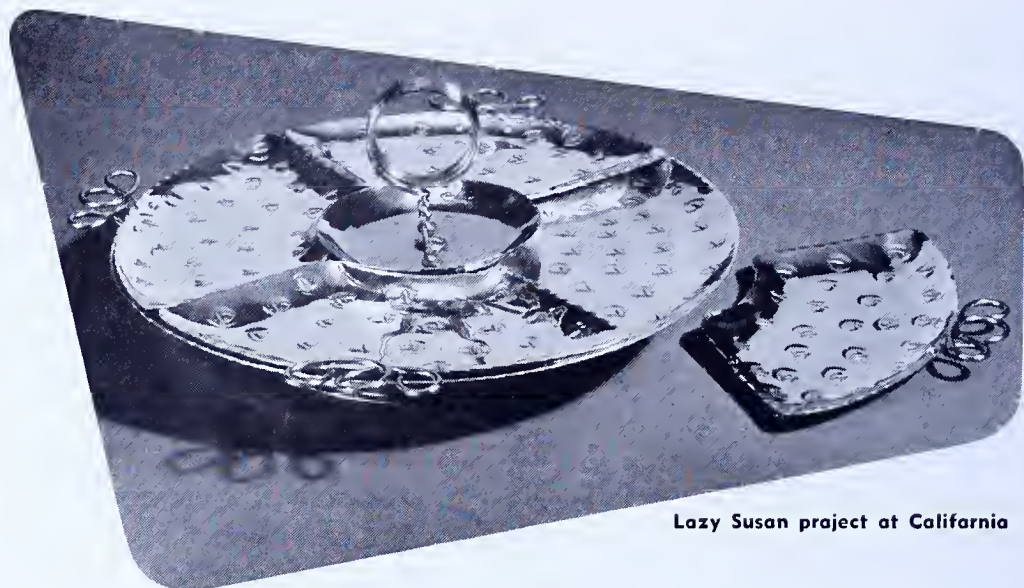
A Suggested Industrial Arts Curriculum

A concentrated schedule in two or more industrial arts shops together with companion courses in the applied sciences and practical mathematics may be provided for 50 per cent of the school week. The other 50 per cent should be scheduled in English, social studies, health and physical education to meet the full requirements of the high school diploma. The shop schedule should provide for the broadest possible exploration of materials and equipment available by routing the student through every activity. The companion subjects should also be specially adapted and enriched to make practical application at the student level.

Senior High School Industrial Arts Curriculum*

GRADE 10	CONTENT	PERIODS	UNITS
English	Reading and Speaking	5	1
Social Studies	Civics	3	$\frac{1}{2}$
Health and Physical Education	Nutrition	2	$\frac{1}{3}$
Science	General	2	$\frac{1}{2}$
Mathematics	Review	5	1
Shop	One Shop	10	1
		<hr/>	<hr/>
		27	$4\frac{1}{3}$
GRADE 11			
English	Biography and Industrial Literature	5	1
Social Studies	Economic and Social Problems	5	1
Health and Physical Education	Safety Education	2	$\frac{1}{3}$
Science	Physics	4-1 Rec.	$\frac{3}{4}$
Mathematics	Algebra and Plane Geometry	5	1
Shop	Other Shop	8	1
		<hr/>	<hr/>
		28	5+
GRADE 12			
English	Practical Composition and Discussion	5	1
Social Studies	Industrial Relations	3	$\frac{1}{2}$
Health and Physical Education	Healthful Living	2	$\frac{1}{3}$
Science	Physics, Chemistry	4-1 Rec.	$\frac{3}{4}$
Mathematics	Plane, Trigonometry	5	1
Shop	Freedom of All	8	1
		<hr/>	<hr/>
		28	$4\frac{1}{2}+$

* The above schedule is based on 55-minute periods.



Lazy Susan project at California

Industrial Arts for Girls

Instruction in the arts and mechanics of our industrial society when offered in public schools is usually restricted to boys. Girls enrolled in homemaking classes receive instruction in the operation of various household appliances but not in the mechanics and technology of equipment which would result in more effective and intelligent utilization. Every home has many electrical and mechanical devices under the nominal control of the homemaker for food preservation and preparation, heating and ventilating, sanitation and hygiene, illumination and labor saving. In addition the care of floors, finishes, walls, fixtures, and accessories, with modern chemical agents makes incidental knowledge inadequate for safe and efficient living in the modern home.

Objectives in Girls' Programs

This educational program should be fitted to the needs of the girl in the secondary school with opportunity for exploration and manipulation. Passive participation or reading does not create a sense of achievement. Need for an activity plus usefulness must decide what is offered. Employment skills are not an objective, although girls with practical experiences gained in Industrial Arts education fit more readily into occupations where women are employed. The chief object should be experiences with electrical appliances, plumbing equipment, ceramics,

textiles, plastics, metals, wood and graphic arts. Developing out of these experiences will be the satisfying of these objectives:

1. Interest in materials in the home.
2. Acceptable attitudes, habits, and character traits while working together in class.
3. An appreciation of excellence in workmanship and design.
4. An appreciation of values of modern industrial materials and products.
5. An opportunity to construct useful articles of art and utility.
6. Experience in using tools, materials, and some machines by means of the articles produced.
7. Necessary information for wise selection, care, and use of common products in the home.
8. An insight into the technology which has created all of the labor saving devices in the average home.
9. Direction for living in a democracy.
10. Healthful hobbies which can bring mental relaxation.
11. Suggestive experiences whereby students will become interested in the maintenance of the home, garden, and automobile.
12. The use of tools and appliances in Industrial Arts education, and an understanding of the safety factors necessary at home.

Media of Achievement

In addition to shop instruction, these objectives are achieved by means of:

1. Planned and organized trips to potteries, furniture factories, stores, and museums, etc.
2. Commercial exhibits, posters, movies, strip films, and slides.
3. Live operating units, such as refrigerators, washing machines, plumbing fixtures, gas meter and shut-off valve, electric main switch and meter, together with branch circuits from which the above appliances will operate.
4. Units might be built to represent the rooms of a modern house with doors, windows, floors, and fixtures.

Cutaway sections may be made showing interiors and working parts of the house and the equipment. The average general shop lends itself to this treatment. Such equipment is vital for teaching boys and girls the home ownership values and functions of these appliances.



Candle Holder project at California

Types of Industrial Arts Shops in Secondary Schools

A school district, instituting or enlarging an Industrial Arts program in its secondary schools may choose a type of shop organization best suited to its needs. Three well-recognized choices are:

1. The Comprehensive General Shop
2. The General Unit Shop
3. The Unit Shop

Comprehensive General Shop

The Comprehensive General Shop is designed to provide instruction in a variety of activities, carried on in separate work areas within the same shop. Thus a shop of this type could have a metal area, a wood area, a planning area, a graphic arts area, and so on. Work is in progress in all areas at once, or in any chosen number of areas. This type of shop is most commonly found in districts having only one teacher of Industrial Arts. It is an economical plan for providing a wide range of activities in one room. Because one teacher directs a number of different activities, he must be broadly trained and basically capable. The Comprehensive General Shop is a comparative newcomer among the types of shops, but experience has clearly shown that it is the most economical plan by which a one-shop school district can provide a modern Industrial Arts program.

*"The general shop provides
... a wide range of
activities ... as*



*'foundry,' 'sheet metal,'
and 'machine work' ..."*

Photos courtesy Erie and Pittsburgh Public Schools

General Unit Shop

The general unit shop provides for a wide range of activities confined to *one general classification of material*. Thus a general metal shop will provide work areas in foundry, sheet metal, machine tool, forging, and so on in metal production activity. The diversity of equipment, range of materials, and project possibilities dovetail very well into the aims and objectives of Industrial Arts and yet limit the problems of teacher preparation and activity organization.

The general unit shop is recommended when more than two and not more than five shop units are required to meet the Industrial Arts needs of a school district. The shop titles are broad and indicate the wide range of activities which may be included. Approved titles presently used are: General Metal Shop, General Graphic Arts Shop, General Motive Power Shop, General Home Mechanics Shop, and General Wood Shop.

Unit Shop

The unit shop is limited to work in *one industrial material* such as wood, or sheet metal or electricity. Such organization finds greatest usefulness in senior high schools requiring many shops to meet the needs of the pupil capacity of the building. The unit shop is inclined towards vocational methods, procedures and objectives, and seldom adequately fulfills the broader objectives of Industrial Arts Education.

Since the range of work is limited to one material, much duplication of equipment is required to provide work stations for the groups of average size. The preparation of the teacher requires concentration in one field and the material limits the possibilities of using the project method as the vehicle of instruction.

The unit shop is losing ground as a true Industrial Arts organization, but will continue to find favor when the demand is for a hybrid organization having some of the features of both Industrial Arts and Vocational Industrial Education.

Time Allotment and Scheduling

Industrial Arts programs present some peculiar problems in scheduling classes. Here as in health and gymnasium work, boys are usually separated from girls. This requires finding teachers and suitable rooms for both groups. Splitting an academic class, even when boys and girls are equal in number, often results in a shop class so small that the

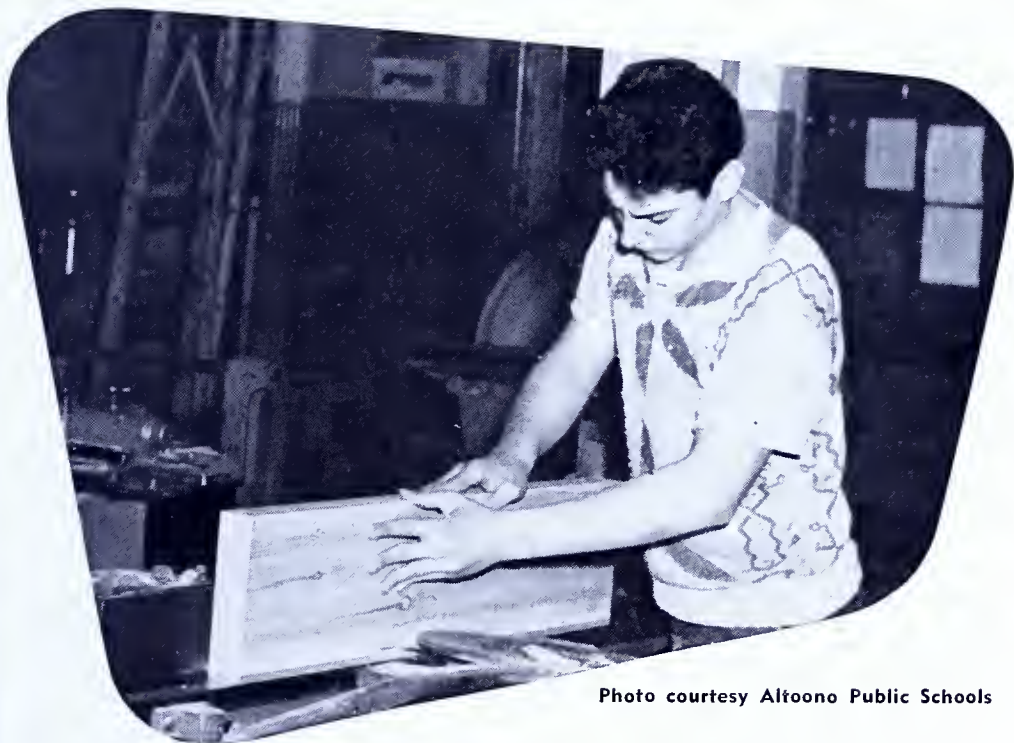


Photo courtesy Altoono Public Schools

"The unit shop is limited to work in one industrial material, such as 'wood' . . ."

cost per student becomes very high. Splitting two academic classes frequently results in too many students for the shop, and unlike many other school activities overcrowding increases safety hazards.

Bases for Class Scheduling

Class schedules in general have as their basic objectives:

1. Provision for sufficient time for a student to attain the credits or the units necessary for graduation.
2. Keeping students occupied for the entire school day.
3. Keeping the teaching load equal.
4. Providing a variety of school experiences.

The schedule should be determined for a grade, or for sections within a grade. Individual schedules should be developed from the group or the schedules for individual students should be prepared and then grouped in order to form classes. By either method, the schedule must become applicable to each student.

Longer Periods for Industrial Arts

School administrators and teachers of Industrial Arts do not claim that Industrial Arts courses prepare students for specific jobs. They can justly claim with support of employers that a properly-conducted program will do much to help students fit more easily into employment.

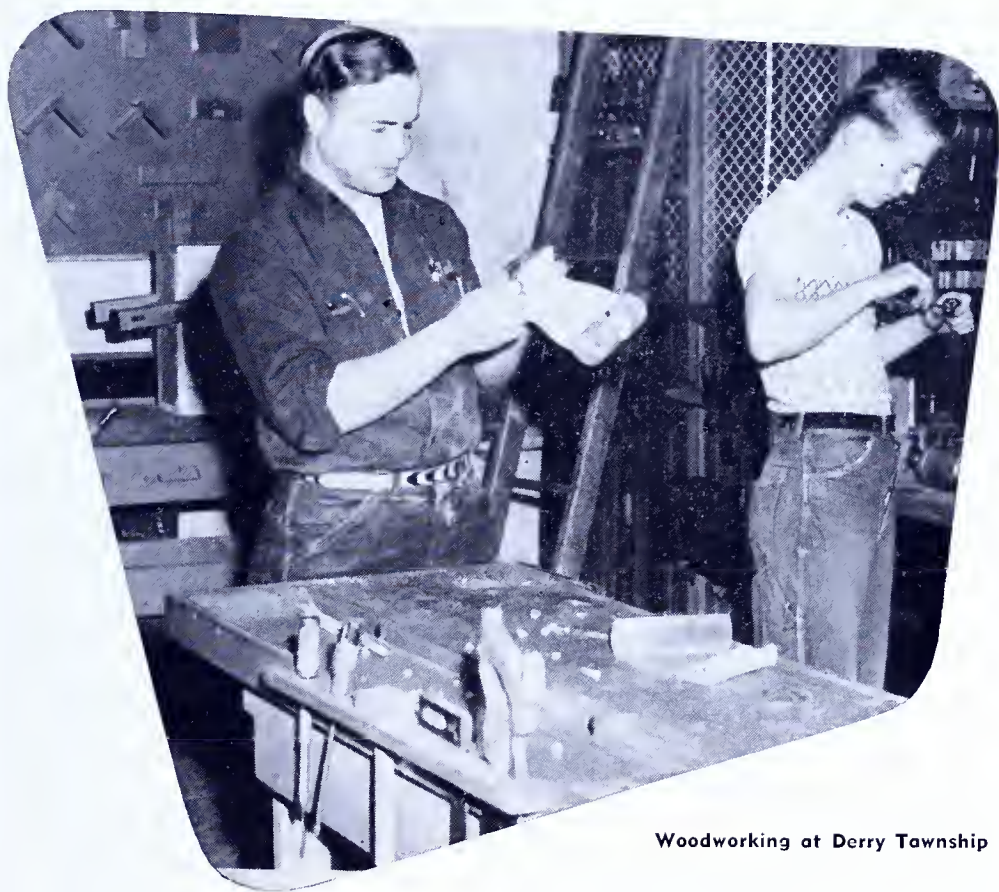
One of the problems of youth who enter employment is the need for adjustment to the rigorous and exacting time schedule of employment. Until enrollment in junior high school, and frequently until graduation from the senior high school, students have never had to maintain sustained interest in an assignment beyond a single class period. Yet the machines of industry demand attention for an entire work day. Industrial Arts, with longer periods for shopwork, helps students to prepare for this condition of modern industry.

Educators in some schools are experimenting with the idea of an intensive study of one subject until that subject has been completed. There are possibilities for the use of the intensive plan for shopwork, especially since this is one characteristic common to almost all industrial employment.

Industrial Arts can do much for youth who are not planning to enter college, especially those desiring to enter employment upon graduation from the secondary schools. In fact, as stated on page 56, local districts may deem it advisable to schedule Industrial Arts for the major part of the student's schedule. It is not too visionary to have a plan whereby some boys who want to quit school can be given nothing but shop for at least their last year before leaving school.

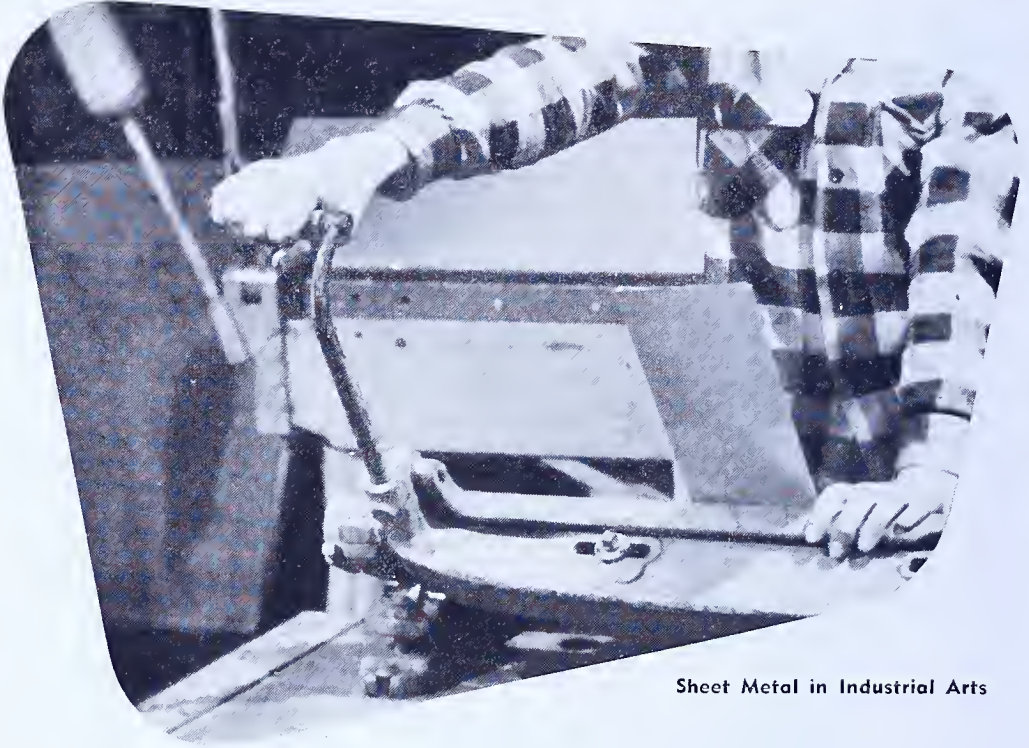
One-Period Classes vs. Two-Period Classes

The one-period shop schedule is the least efficient arrangement. The set-up and clean-up time is fairly standard for any length of session. The in-between shop time is the important consideration. A 60-minute period may net only 45 minutes for shopwork while a two-hour period may net 105 minutes. A short active shop session before academic classes makes the academic teacher's job more difficult. Concentrated shop sessions, longer but fewer in number, lessen this difficulty. There are many crucial time-absorbing situations in shopwork, such as glueing, baking, heating, cooling, and finishing, where such desirable operations become impossible because they cannot be completed during a short class session.



Woodworking at Derry Township

School administrators may use the following idea in scheduling: They may group the subjects usually scheduled, for example, two or three hours per week and those which require five hours per week. They then set up a six-day cycle instead of the usual five-day repetition for the three-hour-per-week subjects. This rotation plan is especially adaptable to the Industrial Arts program in the junior high school. If, for example, there were four of the short-time subjects, the individual student spends all of the time devoted to one short-time subject during the first quarter of the semester (or of the year). The Industrial Arts students are rotated each quarter and the Industrial Arts teacher secures a new group each quarter. A four-subject quarterly rotation plan thus quadruples the shop session time. Even a two-subject rotation doubles the shop time. It must be noted that the advantage accrues also to the other subjects to which the rotation is applied.



Sheet Metal in Industrial Arts

Special Schedules

Special schedules for senior high school students are frequently used. Students may be scheduled for a few or many hours per week. Usually the schedule calls for at least one double period per week for the college preparatory student, five hours for the pre-engineering student, and 10 to 15 periods per week for the great number of students who will not go to college. The 10-period per week schedule may be combined in any manner. Five two-hour sessions are frequently used. For a 15-period per week schedule, half-day work fits admirably with a shop session all of each morning or all of the afternoon.

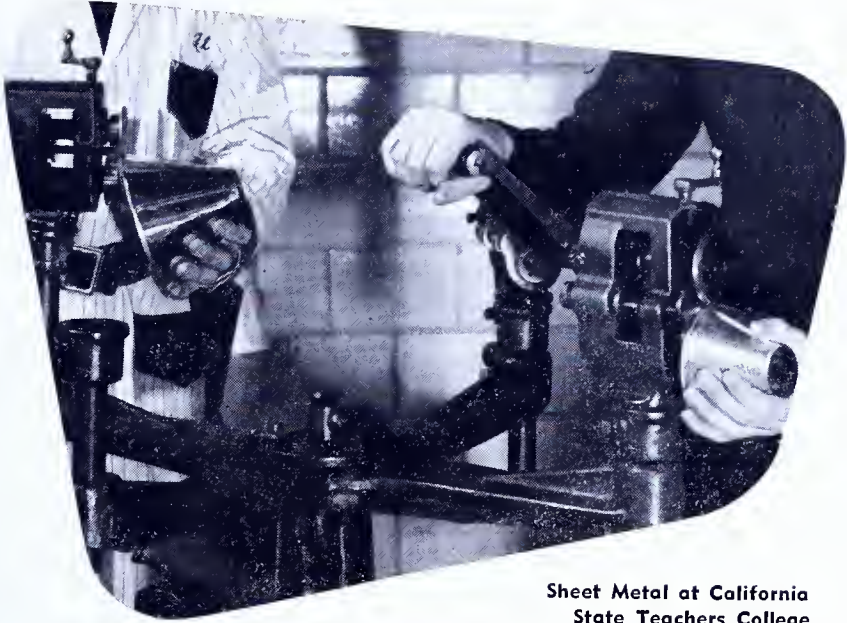
If, in high school, there are 10 students scheduled each morning for three hours on a 15-period-per-week basis, then additional students electing a lesser number may be scheduled with the 15-period-per-week group as long as the load on the teacher and on the work stations does not impair efficiency.

State-Recommended Time Schedules

Industrial Arts instruction is mandatory for all boys in the three years of the junior high school program. It should be available and

elective for both boys and girls in the secondary school. A minimum of 120 minutes per week is mandated for all boys in each year of the approved junior high school program. This may be provided in two or four periods per week of 50 or 60 minutes. If 45-minute periods are used, the minimum number of periods must be three. Note that this is an emendation of page 29 in Bulletin 241, *Secondary School Manual*.

It is advisable to schedule double periods in shopwork to minimize the loss of time in getting underway and closing the class session. Quite frequently individual pupils should be scheduled for additional work in the shop. Boys and girls may be grouped together heterogeneously for shopwork. The major consideration is one of safety which can be best controlled by limiting the group size to the work station capacity of the shop and the ability of the teacher to command the total situation.



Sheet Metal at California
State Teachers College

The Administrative Aspects

Supervision of Industrial Arts

A Plan for Supervision

Responsibilities of Supervisors

Industrial Arts Public Relations

How to Build Good Public Relations

School Maintenance and Production Work

Class Size

Segregated Classes

Industrial Arts Library

Purposes

Classification of Books

Supervision of Industrial Arts

IV. The Administrative Aspects

STATE SUPERVISION of Industrial Arts Education is conducted by the Chief of Trade and Industrial Education through the State Area Coordinators of Trade and Industrial Education located at the three vocational-industrial teacher education institutions—The Pennsylvania State College, the University of Pittsburgh, and the University of Pennsylvania. In their supervisory capacity these coordinators visit local school administrators and Industrial Arts teachers, observe existing conditions, and prepare recommendations for the general improvement of the program.

Within the local district the Industrial Arts program is supervised by the school administrator, the director of vocational education where programs of vocational education are included in the program of studies, by a designated supervisor of Industrial Arts, or through a head teacher.

In order to coordinate local school district and county Industrial Arts programs, and to improve instruction in districts employing more than one Industrial Arts teacher, the following plans are suggested:

A Plan for Supervision

1. In secondary schools employing several teachers of Industrial Arts, one of the teachers may be designated as head teacher of Industrial Arts. It is his duty to help coordinate the instruction under a superior school officer. He should be given a limited but sufficient amount of time out of his teaching or total service load to provide this coordinating function.

2. In school districts employing more than five Industrial Arts teachers, a head of the department of Industrial Arts should be designated. His total service load should be reduced somewhat to provide the time needed to do this work well, or he might be given extra compensation for service beyond the normal school day.

3. In school districts or counties employing many Industrial Arts teachers, a supervisor of Industrial Arts may be designated. His serv-

Teacher assigned as Head of Industrial Arts for several teachers:



Head of Industrial Arts appointed for more than 5 teachers:



Full time Industrial Arts Supervisor appointed for more than 20 teachers:



ices as a supervisor may be part-time along with teaching if the number of Industrial Arts teachers is less than 20. If the number of Industrial Arts teachers is more than 20, the supervisory service should approach or be on a full-time basis.

These supervisory positions in Industrial Arts should be staff services, and the individuals should be responsible either to a school principal, to a director of industrial education, to a district superintendent, to a supervising principal, or to a county superintendent.

Responsibilities of Supervision

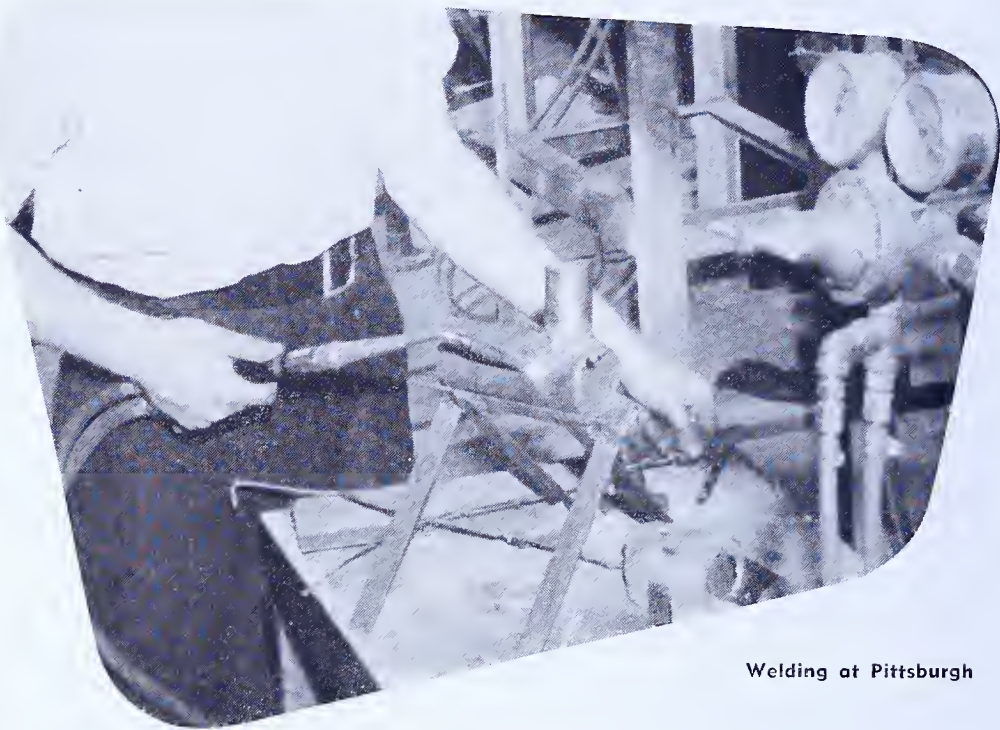
In the supervision of Industrial Arts attention should be given to the following responsibilities:

1. Professional relations of the supervisor to school administrators, teachers, teacher educators, and other supervisors.
2. The supervisor should provide the teacher with
 - Notices of new professional Industrial Arts publications.
 - Notices of new instructional material.
 - References on related informational materials.
 - Descriptions and illustrations of new and interesting projects.
 - Manipulative tips picked up on visits to other school shops.
 - Information received at conferences and conventions.
 - Information about new Industrial Arts products appearing on the market.
 - Promotion of safety practices in school shops.

3. Administration. The supervisor is responsible for
 - Acquainting school officials and the general public with the philosophy aims and objectives of Industrial Arts.
 - Assisting administrators in the promotion of programs of Industrial Arts.
 - Assistance in planning, reorganizing, and modernizing Industrial Arts shops.
 - Assisting in the selection and securing of suitable and qualified teachers.
4. The teacher. The supervisor should
 - Cooperate with programs of teacher education in Industrial Arts.
 - Upgrade in-service teachers.
 - Promote orientation of new teachers in their first professional jobs.
 - Counsel with individual teachers.
 - Stimulate group meetings of Industrial Arts teachers.
5. Physical plant and equipment. The supervisor should
 - Assist in the remodeling of existing plants.
 - Assist in the planning of new shops.
 - Assist in equipping shops.
 - Promote safety.
 - Advise on good housekeeping, care of equipment and tools, storage and issuing of supplies, and on general functioning and appearance of the shop.
6. Instructional supervision. It is a part of the supervisor's work to
 - Establish and work with curriculum committees.
 - Prepare for or assist teachers in the preparation of course materials.
 - Visit the school shops and supervise techniques of instruction.
 - Evaluate the work being done by the students in the shops.

Industrial Arts Public Relations

The student is the greatest interpreter of the school in the community, therefore the student is of prime importance in any program of school public relations. What the student says about his teacher or program of studies at the dinner table is often the only link between the school and the home. A happily adjusted student who speaks well of his teachers and program of studies is a great asset in any school public relations program. Any successful long-range public relations program must be built around the development of good human relationships with students. No other teacher in our secondary schools has a greater opportunity to help students become happily adjusted



Welding at Pittsburgh

citizens of the school and the community than has the Industrial Arts teacher.

How to Build Good Public Relations

Some of the more effective ways in which the Industrial Arts teacher may build up good public relations follow:

1. Explain clearly to students, parents, faculty members, and the general public the aims and objectives of Industrial Arts education.
2. Assist every student in the Industrial Arts program to have a happy experience through the successful completion of a project.
3. Be genuinely sympathetic toward students with their everyday problems. "Only the teacher who loves can teach and only the child that is loved can learn."¹
4. Consider it an important part of the public relations program to visit homes of students and to accept invitations to visit homes when extended by students or parents.

¹ *Conclusion of a Workshop*, U. S. Office of Education, as reported by Michael Paca, School Shop, Vol. IX, No. 4, Dec. 1949, p. 28.

5. Continually extend invitations to parents and the public to visit the Industrial Arts shop during school hours.

6. In the use of exhibits in the school or in store windows, make students the center of the exhibit and not the projects. This can be done by:

- a. Publicizing the names of students in connection with projects made.
- b. Using photographs of students and the projects they make.
- c. Having students write articles about the Industrial Arts exhibits for newspapers, radio scripts, and school paper.
- d. Permitting students to arrange for exhibits, displaying the projects, and acting as guides.

7. Cooperate with the Salvation Army, Red Cross, or Service Clubs in the repair of broken toys to be distributed by these agencies during Christmas.

8. Arrange for an "Open House" when parents and the public are given a special invitation to see the Industrial Arts program in operation.

9. Arrange for class visits to local industrial plants.

10. Invite industrial people to visit the school and talk to the Industrial Arts classes.

11. Actively participate as a leader in some out-of-school youth program, such as the Boy Scouts, the Little League Baseball teams, Boys' Clubs, or the YMCA.

12. Provide an opportunity for students to work in the school shop after school hours on Industrial Arts projects.

13. Encourage the local school administration to permit the use of the Industrial Arts shop for adult evening classes.

School Maintenance and Production Work

Effective Industrial Arts instruction involves purposing, planning, and executing on the part of the student. It follows, therefore, that the project should originate with the student, subjected to the influences of the teacher in deriving the greatest educational value from the job at hand. The assignment of school plant maintenance problems and production of school equipment items to the shop teacher without a soundly established policy in connection therewith, seriously interferes with the planned instruction program of Industrial Arts.



Radio at Lancaster

There are situations and conditions under which the instructor should welcome the opportunity to have work for the school in readiness. Consider the following situations:

- a. A student cannot afford to pay for the materials needed to make an involved project commensurate with his advanced skill and technical knowledge.
- b. A student cannot be motivated to purpose and plan to do anything. The instructor must assign a task according to the lad's ability involving minimum cost, and yet the item made should be of some value to the school or community.
- c. A stage prop is needed and the planning and production involved can well be handled in the shop with sound educational values for one or more students.
- d. The self-centered student could benefit by a shop assignment of a project of value to the group through which he has an opportunity to learn certain ideals of cooperation and consideration of others.

It is desirable that a policy be created by the administrator directing school maintenance and production problems to the attention of the Industrial Arts instructor. The instructor should have the authority to

accept or reject any such items and have the privilege to work them into his program for the best educational values involved. He should maintain a work order file with detailed information and should be free to secure the necessary materials needed to do a workmanlike job. To assign such tasks to the teacher as rush orders or to require that he do such maintenance work himself can hardly be defended. The teacher should not be expected to absent himself from scheduled classes to perform a maintenance task or direct others in doing such tasks while the majority of students remain in the shop. To do so is educationally unsound and hazardous to the health and welfare of the students involved.

INSTRUCTION:

Up to 22 students



"POLICING":

Over 22 students



"Industrial Arts classes should be generally limited to 22 students."

Class Size

The size of an Industrial Arts class is determined by the area of the shop, the number of work stations, the tools, equipment, and supplies provided for the particular type of instruction.

Industrial Arts classes should generally be limited to a maximum of 22 students, provided the shop is equipped with 22 work stations, the necessary tools, equipment and supplies to provide adequate learning experiences for this number of students.

An Industrial Arts class of 22 students of average ability lends itself very well to an adequate distribution of students to the general activities offered in the Industrial Arts program and conforms with the standard unit used in the reimbursement for general education.

It has been found that an Industrial Arts teacher is able to do his best teaching and students perform their best, when classes are limited to this number, as it permits the teacher to instruct rather than police students. Policing is about all a teacher is able to do when classes in Industrial Arts exceed 22.

If an Industrial Arts teacher has a class of low ability, whether the class is classified as special education or not, the number of students in the class should not exceed 15.

Segregated Classes

Segregation of students in Industrial Arts classes on the basis of general intelligence is not generally a requirement, except in the case of those who are assigned to special education programs or their equivalent in Industrial Arts.

For at least 40 years Industrial Arts has been organized and taught so as to provide many avenues for recognition of different degrees of ability to achieve in the manual, informative, and appreciative content of instruction. Industrial Arts classes provide excellent opportunities to overcome some of the antisocial conditions and attitudes resulting from segregation on the basis of general intelligence. Industrial Arts welcomes the opportunity to provide differentiated learning for all youth, with association on the same basis as will be required of all these youth when they take their places in the adult world.

Studies indicate clearly that the correlation between intelligence and achievement in and knowledge of industrial activities is positive, but so low as to be of little predictive value.

Industrial Arts Library

In order to satisfy the existing need for strengthening and expanding the instruction given by the teacher to his students, the Industrial Arts shop library is an essential. Detailed information concerning the fundamental mechanical operations on the projects cannot be satisfactorily taught unless some printed material is easily accessible.

Purposes of a Library

The reasons for a library of this type are many. It aids the interested student:

1. In developing an appreciation for the advances in modern industrial products, for workmanship and design, along with developing his skill in the fundamental processes of interpreting drawings and illustrations.
2. In choosing a vocation in which he may determine his capabilities, limitations, and interests.
3. In planning and problem solving.
4. In making use of leisure time, both as a hobby and as the "handyman" about the home by giving detailed information.

Classification of Books

Because only one book cannot adequately cover all subjects equally well, a definite need exists for a variety of books. In view of this fact, the various kinds of books may be classified as follows:

1. Project or problem books.
2. Shop manuals.
3. Reference books.
4. Magazines.
5. Occupational books.

The project or problem book, in most cases, furnishes new and varied ideas, drawings, and designs that may be used in the shop. The use of this book takes for granted that the student possesses a certain basic knowledge of the use of tools. The shop manual serves the purpose of furnishing working directions and other data, such as bills of material, drawings, and tools to be used.

Reference books are of the informational type concerning the special uses of tools, equipment and machinery, and for comparing methods of solving problems.

Combining all data of the previously mentioned three classes of books are the magazines of unestimable value to the shop library in conveying information to the students and teacher.

Occupation books present information concerning the various occupations at which men work and assist the students in their selection of an occupation.



Woodworking at Lancaster

The Legal Aspects

School Law and Industrial Arts

Approval of the Industrial Arts Program

Building and Facility Approval

Purchasing Industrial Arts Materials and Supplies

Selection and Employment of Industrial Arts Teachers

Industrial Arts Mandated for Secondary Schools

Basis of Approval

Regulations Governing Certificates

Certification of Industrial Arts Teachers

Regulations

Extension of College Certificates

Extension of Standard Certificates

Validity of Certificates

History Requirement

The 1949 School Laws and Industrial Arts

V. The Legal Aspects

Approval of the Industrial Arts Program

INDUSTRIAL ARTS education in the public schools of Pennsylvania is recognized as an important part of general education. Within the Department of Public Instruction, administrative responsibility for Industrial Arts has always been associated with the Division of Trade and Industrial Education.

SECTION 2810. The Department of Public Instruction shall have the power, and its duty shall be: . . . (b) To investigate the need for and aid in the establishment of, supervise, inspect, and approve, for the purpose of reimbursement on the part of the State, schools, departments, and courses, for agricultural, industrial, commercial, and home economics, mining, and other vocational and practical education, as well as continuation schools, when maintained as a part of the public school system of the Commonwealth. *Pennsylvania School Laws, 1949.*

This section clearly includes the area of instruction now designated as Industrial Arts. To clearly implement this enactment, the Division of Trade and Industrial Education has been delegated administrative responsibility for Industrial Arts in the public secondary schools. Approval of that division is required for all local school districts' plans and proposals affecting Industrial Arts before the local school district can legally set up and operate an Industrial Arts program.

Building and Facility Approval

Before a building or facility is planned to be used for Industrial Arts instructional purposes, in accordance with the Pennsylvania School Laws it shall be approved by the State Council of Education and the Department of Labor and Industry.

SECTION 731. No public school buildings shall be contracted for, constructed, or reconstructed, in any school district of the second, third, or fourth class, until their plans and specifications have been submitted to the State Council of Education, and all recommendations concerning the same by the State Council of Education have been laid before the board of school directors: Provided, That where ordinary repairs are proposed, such as plastering, painting, replacement of floors, improvements of school grounds, repairing or providing walks, roadways or retaining walls, the cost of which in districts of the second class will not exceed one thousand dollars (\$1,000), or in districts of the third and fourth class will not exceed five hundred dollars (\$500), no submission of plans for such repairs to the State Council of Education shall be required. Where any structural change is involved, such as moving or adding doors, windows, partitions, making additions or any excavations, submission of plans to the State

Council of Education shall be required regardless of the cost of such structural change.

SECTION 3148. It shall be the duty of the owner, architect, or contractor, of every building or structure, as described in this act, hereafter erected, adapted, remodeled, or altered, to submit to the Department of Labor and Industry for approval, architectural drawings, specifications, or other data showing compliance with the provisions of this act and the rules and regulations of the said department which may be promulgated for the enforcement of the provisions of this act. No such building or structure shall be erected, adapted, remodeled or altered, until such plans have been examined and approval given by the Department of Labor and Industry, and a building permit obtained in municipalities where such permit is required by ordinance.

SECTION 3149. Before any building or structure hereafter erected, adapted, remodeled, or altered shall be used or opened for occupancy, the owner thereof shall notify the Department of Labor and Industry of the completion of the erection, adaption, remodeling, or alteration of the said building or structure. If the Department of Labor and Industry finds, after proper investigation that the building or structure complies with the requirements of this act, and the rules and regulations promulgated for the enforcement of the provisions of this act, then the said department shall issue to the owner of the building or structure a permit authorizing the occupancy of the use of the building.

Purchasing Industrial Arts Equipment and Supplies

The School Laws of Pennsylvania indicate the following procedure for purchasing Industrial Arts equipment and supplies:

SECTION 805. School supplies shall be divided into two classes. The first class shall include school desks, chairs, typewriters, and school apparatus. The second class shall include maps, globes, and all other supplies, except textbooks necessary for school use, not included in the first class. The board of school directors in any district may authorize or appoint the secretary of the board or other executive or purchasing agent for the district, with authority to purchase supplies of either class costing less than one hundred dollars (\$100).

SECTION 806. When it is deemed necessary to purchase desks or other supplies of the first class, costing one hundred dollars (\$100) or more, the board of school directors shall solicit sealed quotations from two or more firms, manufacturers, or dealers in such supplies. Such quotations shall be opened at a regular or special meeting of the board of school directors. The board shall accept the bid of the lowest responsible bidder when the kinds and quality of supplies and equipment offered are the same or are equal, but they shall have the right to reject any and all bids or select a single item from any bid. Any school district may purchase school furniture and other equipment from another school district without asking for competitive bids.

SECTION 807. All supplies of the second class, costing three hundred dollars (\$300) or more, shall be purchased and contracts therefor awarded only after public notice has been given by advertisement, published once each week for three weeks in not less than two newspapers of general circulation. In any district where no newspaper is published, said notice may, in lieu of such publication, be posted in at least five public places. Such advertisement or notice shall give all necessary information, or give notice of convenient access thereto, in such manner that bidders can intelligently make bids for such contracts.

The board of school directors shall accept the lowest bid or bids, kind, quality, and material being equal, but shall have the right to reject any and all bids, or select a single item from any bid.

Selection and Employment of Industrial Arts Teachers

The success of an Industrial Arts program depends to a large degree on the type of teacher that the school district selects to take charge. The Industrial Arts teacher is charged not only with the responsibility of the students enrolled in the program, but he is also charged with the responsibility of maintaining a shop equipped with valuable hand and machine tool equipment which represents capital investment of the school district. It is therefore imperative that the teacher selected to take charge of the Industrial Arts program possess outstanding characteristics of leadership, professional attainment and development, ability to work well with others, ability to get along well with people, a high degree of mechanical aptitude and good mechanical judgment in addition to the regular professional requirements set up by the School Laws.

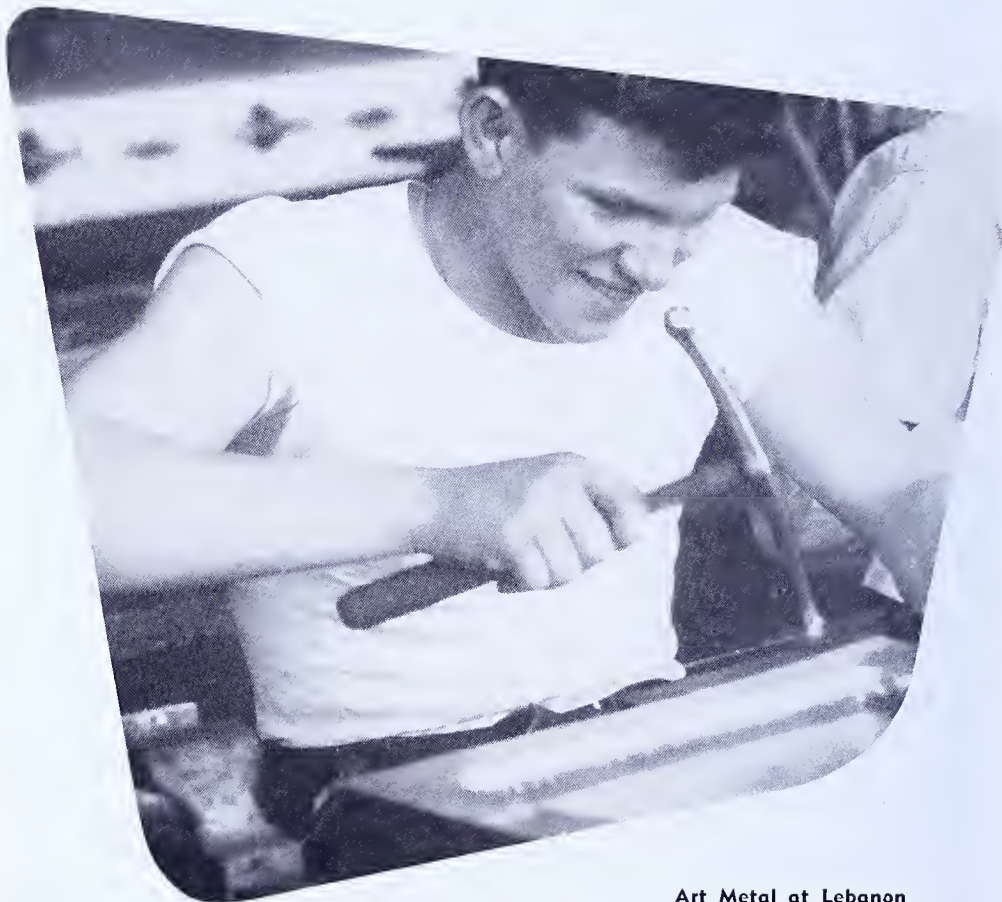
SECTION 1201. Only those persons holding one of the following certificates shall be qualified to teach in the public schools of this Commonwealth—(1) permanent college certificate, (2) provisional college certificate, (3) normal school diploma, (4) normal school certificate, (5) special permanent certificate, (6) special temporary certificate, (7) permanent State certificate, (8) certificates which are permanent licenses to teach by virtue of the provisions of section 1308 of the act, approved the eighteenth day of May, one thousand nine hundred eleven (Pamphlet Laws 309), as amended, which is repealed hereby, or (9) such other kinds of certificates as are issued under the rules and regulations of the State Council of Education. The State Council of Education shall also provide for issuance of certificates by county or district superintendents to meet such emergencies or shortage of teachers as may occur.

SECTION 1202. State certificates shall be issued as herein provided. Each such certificate shall set forth the branches which its holder is entitled to teach. No teacher shall teach, in any public school, any branch which he has not been properly certificated to teach. A certificate to teach shall not be granted or issued to any person not a citizen of the United States, except in the case of exchange teachers not permanently employed and teachers employed for the purpose of teaching foreign languages.

SECTION 1212. Before entering upon the work of teaching, every holder of a permanent, special or State certificate, of any kind, shall present it, for registration, to the proper superintendent, who shall record its kind, number, and date of issue, together with the branches which it covers. Whenever new branches are added to any certificate, these shall be added to the record upon presentation of said certificate to the superintendent.

SECTION 2108. No certificate shall be granted to any person who is not of good moral character, or to any person who shall not first have presented a certificate from a physician recognized by the board of public education as competent for the purpose, setting forth that said applicant is neither mentally nor physically disqualified by reason of tuberculosis, or any other chronic or acute physical defect, from successfully performing the duties of a teacher.

The above quotations are particular sections of the 1949 School Laws of Pennsylvania that affect the Industrial Arts program. They have been lifted from the School Laws in their entirety. No legal interpretations or opinions are presented concerning them.



Art Metal at Lebanon

Industrial Arts Mandated for Secondary Schools

Local school district programs of Industrial Arts instruction are regulated by the Department of Public Instruction as required under Section 1303 of the Administrative Code and Article XVI of Act 14 of the 1949 General Assembly.

Basis of Approval

1. The facility conforms to regulations of the School Plant Division.
2. The fields of instruction are recognized as meeting general education objectives with a broad base for exploration and are sufficiently extensive for specialization in upper grades.
3. The shop or laboratory area provides adequate space for the maximum groups assigned with recognition of student safety factors and proper working conditions.

4. The policies of the school district regarding project construction, student fees, adequate supplies and equipment are conducive to proper instruction.

5. Facilities are adequate to provide a minimum of 120 minutes per week under mandatory situations.

Industrial Arts instruction is mandatory for all boys and elective for girls in the three years of the approved junior high school program.

Industrial Arts instruction shall be available to both boys and girls on an elective basis in an approved senior high school.

It is recommended in every senior high school when two or more Industrial Arts shops or laboratories are or can be made available that a major learning area be centered in Science, Mathematics, and Industrial Arts instruction to the extent of one three-unit aggregate per year for those individuals striving for adjustment to our industrial economy.

Certification of Industrial Arts Teachers

Regulations Governing Certificates Previously Issued

All Temporary, Special, Normal, and Provisional College Certificates now valid will be renewed and made permanent in accordance with the requirements on which they were issued.

Regulations Governing the Issuance of New Certificates

1. *Provisional College Certificates* are issued to graduates of approved four-year teacher education curriculums in Industrial Arts education in accredited colleges and universities.

"General Industrial Arts" will be written on a certificate on the satisfactory completion of an approved four-year Industrial Arts curriculum which includes:

- a. A minimum of six semester hours in professional courses in Industrial Arts education, such as Principles and Practices in Industrial Arts, Curriculum Materials in Industrial Arts, Shop Management and Layout, and Current Problems in Industrial Arts.
- b. A minimum of 30 semester hours in courses in shop activities, including not less than four semester hours in each of four or more shop activities, such as:

Wood
Metal
Graphic Arts
Electricity
Automotives
Ceramics

Plastics
Textiles
Industrial Arts courses specifically designed to meet the needs of persons teaching Industrial Arts in the elementary school
Art Crafts

- c. A minimum of 10 semester hours, and not more than 14 semester hours, in courses in related drawing and design, including at least four of the following:

Mechanical Drawing	Architectural Drafting
Freehand Drawing and Sketching	Machine and Equipment Design
Industrial Arts Design	Graphic Arts Design
Sheet Metal Drafting	

"Industrial Arts activities on a Unit Shop Basis" will be written on a certificate on the satisfactory completion of 12 semester hours of approved education in each activity.

2. *Permanent College Certificate.* The provisional college certificate will be made permanent on evidence of three years of teaching on the provisional college certificate in the public schools of Pennsylvania with a rating of "middle" or better and the satisfactory completion of six semester hours of additional education of collegiate grade, one-half of which must be professional. A course in visual education is required for permanent certification unless it was completed before the degree was received.

Extension of College Certificates to Include Industrial Arts

A college certificate may be extended to include the teaching of Industrial Arts on the satisfactory completion of courses selected from an approved teacher education curriculum in Industrial Arts (action of State Council of Education, December 2, 1938).

Until September 1, 1939—18 semester hours; after September 1, 1939—24 semester hours; after September 1, 1940—30 semester hours.

Extension of Standard Certificates

1. Temporary or permanent standard certificates valid for teaching Industrial Arts may be extended to include additional shop activities on the completion of four semester hours for each general shop activity and 12 semester hours for each unit shop activity.

2. Temporary or permanent standard certificates valid for teaching vocational industrial education may be extended to include Industrial Arts activities on the completion of the minimum requirements for the extension of a college certificate to include Industrial Arts in effect at the time the extension is completed. The courses will be selected from an approved Curriculum in Industrial Arts and will include four semester hours in professional Industrial Arts education. Credit to the extent of 12 semester hours for the vocational shop activity may be granted on the recommendation of the head of an Industrial Arts cur-

riculum as the result of examination or demonstration of competency to teach the shop activity on an Industrial Arts basis.

Validity of Certificates

Certificates in general Industrial Arts, issued to graduates of an approved four-year curriculum in Industrial Arts, are valid for teaching any of the activities in a general shop. Certificates that have been extended to include Industrial Arts are valid for teaching the general shop activities in which four semester hours of approved courses have been completed and are valid for teaching the unit shop activities in which 12 semester hours of approved courses have been completed. All Industrial Arts certificates are valid for teaching in all grades above the sixth and may be extended to include the teaching of Industrial Arts in the elementary school on the completion of four semester hours in Industrial Arts courses specifically designed to meet the needs of persons teaching Industrial Arts in the elementary school.

History Requirement

(Action of State Council of Education, December 4, 1942): "That subsequent to September 1, 1944, all certificates issued by the Department of Public Instruction to teach in the public schools of the Commonwealth shall, in addition to the present regulations, require a basic course in the history of the United States and Pennsylvania."



Wood Turning at Shamokin

The Instructional Aspects

Student Personnel Organization

Instructional Aids

Instruction Sheets, Testing Sheets, Student Analysis and Planning Sheets

Field Trips

Models and Mock-Ups

Motion Pictures and Film Strips

Film Libraries and other Film Sources

Control of Tools and Supplies

The Pupil-Teacher Planning Area

Aids for Student Project Selection and Planning

Housing and Layout for Industrial Arts

Steps in Planning Industrial Arts Shops, Shop Building, Types of Construction, Flexibility and Expansibility, Dimensions, Open Shop Area, Auxiliary Rooms and Facilities, Visual Comfort and Efficiency, Lighting, Ventilation, Heating, Flooring, Color, Acoustical Treatment, Walls, Ceilings, Insulation

Student Personnel Organization

VI. The Instructional Aspects

THE STUDENT PERSONNEL organization of any Industrial Arts program should

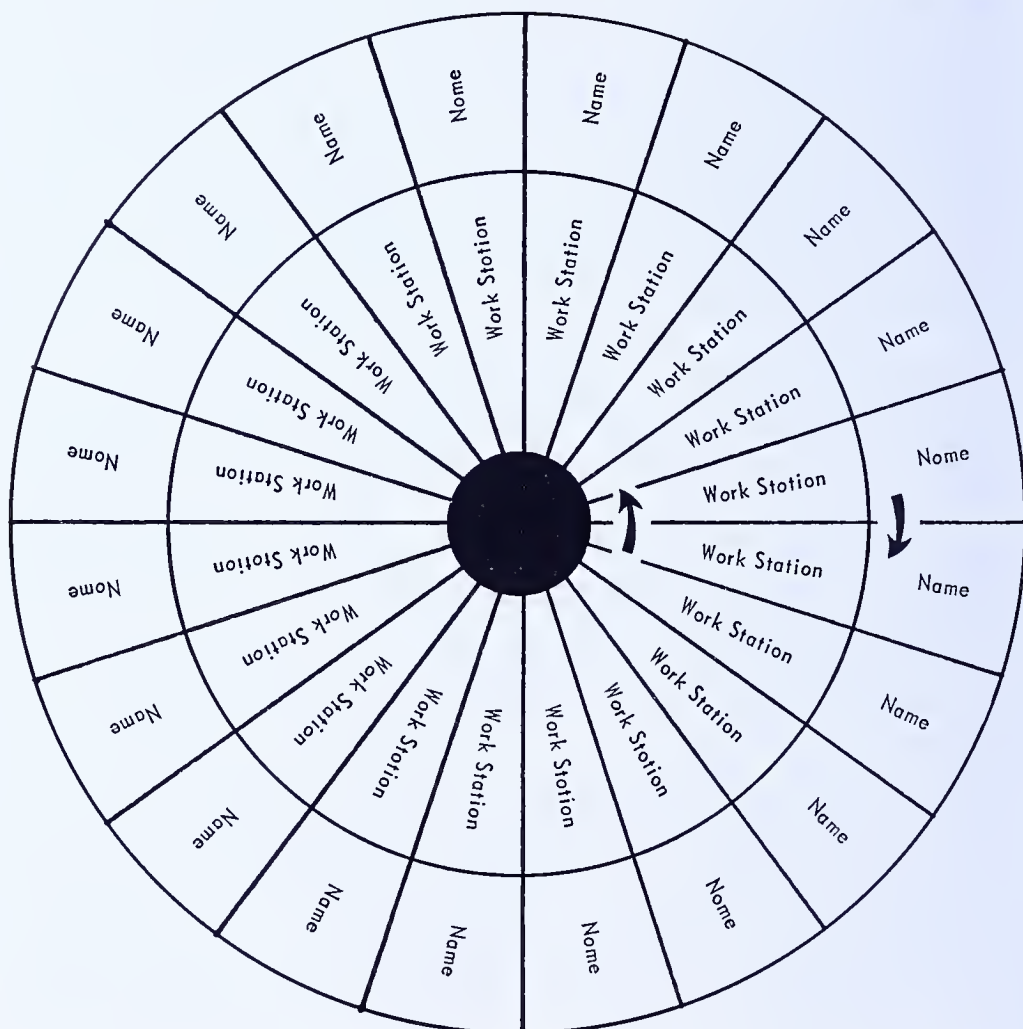
1. Be an educative experience, contributing to the student's knowledge of such things as industrial procedures, tools, machines, workers, safety, and management.
2. Be carefully planned.
3. Be controlled by the Industrial Arts teacher with devices for assigning and rotating students.
4. Be limited in complexity and degree so as not to consume more class time and effort than its importance warrants in a given course.
5. Be of such a nature as to provide training in both leadership and followership.
6. Be representative of its counterpart in industry.
7. Be adapted to such varying conditions in different Industrial Arts courses as grade level, chief purpose, equipment, and kinds of students.
8. Be democratically controlled by students in those instances where they are so controlled by employes in industry, as in matters of safety, suggestions for improvement, and grievances.
9. Be planned with a differential to take care of unpredictable conditions that may arise.
10. Be operated with some kind of teacher-initiated student-training and induction system for assignees.
11. Be understood by all students.
12. Be organized so as to use some of the best qualified students at the beginning of its operation.
13. Be organized so that the degrees of performance of each student can be evaluated and recorded.

Student-Operated Controls

The particular student-operated controls employed depend upon various factors in the course to be taught. The students are usually selected as assistants or foremen for:

1. Tool control.
2. Lubrication of equipment.
3. Maintenance of equipment.
4. Assistant to the teacher.
5. Shop safety (committee).
6. Stock and supply control.
7. Finishing area.
8. Planning area.
9. Library facilities.
10. Paper work, which can be delegated.
11. Clean-up of equipment to floor level.
12. Blueprints and instruction sheets.

Assignment devices, for indicating work stations for either clean-up or duties, may be used to insure that each student is rotated to all areas of work in the shop. In the accompanying illustration, the outer



rotating disc contains names of students. The inner rotating disc contains various work stations or various duties usually assigned. Made of cardboard, the outer disc can be moved one place each day, making automatic assignments.



Electricity at Shamokin

Instructional Aids

Instruction Sheets

One of the most extensively used and valuable instructional aids in Industrial Arts today is the instruction sheet. There are six types of these sheets:

1. Operation sheets.
2. Information sheets.
3. Assignment sheets.
4. Job sheets.
5. Test sheets.
6. Student analysis and planning sheets.

Because of the variety of activities conducted in the general shop, the instruction sheet can be used to the greatest advantage in this type of shop. However, since this aid has its limitations, it must not take precedence over other means of instruction due to the difficulties which may later arise if this method supersedes all other forms of instruction.

The advantages of the instruction sheet when properly used are many:

1. It introduces variety into the shop.
2. It saves time of both teacher and pupil.

3. It maintains interest—no waiting for the next block of information from the teacher; thus, it provides the incentive to accomplishment.
4. It furnishes printed directions, the method used in modern industry for conveying the information necessary to proceed with a job.
5. It serves as a check for the student who does not have to copy instructions or have the teacher reiterate the information previously given.
6. It provides better organization for procedure and necessary equipment than oral instruction.

On the other hand, if the teacher misuses the instruction sheet by having it replace all other methods, the following difficulties may result:

1. Substitution of instruction sheet for personal instruction.
2. Failure on the part of the teacher to maintain high standards of workmanship.
3. A tendency to revert to irregularity in class conduct and organization, especially when work is uninteresting with no personal contact with the teacher.
4. Waste of material and damage to tools which may involve accidents and personal safety.
5. A placing of students with poor reading ability under a serious handicap.

In conclusion, the value of the instruction sheet depends largely upon the manner in which it is used. It should always be a supplement to the teacher's personal instruction.

Testing Sheets

The test may be considered a form of instruction sheet. It is useful in the following ways:

1. The student is given several tools which he is to identify and give their uses as related to the area in which he is working.
2. Materials, such as woods or plastics, are given to the student to name and give appropriate uses for them.
3. The tests on theory, rather than practice, will reveal what the student has retained of the material taught to him. Reteaching or demonstration will complete the instruction.
4. The pretest or check sheet reveals what should be taught.

The individual attention in regard to instructions will depend upon the size of the class as well as the supply of well-developed instruction sheets.

Student Analysis and Planning Sheets

The analysis and planning sheet enumerates all the steps required to complete an operation from the roughing to the finishing stage as well as indicating the tools to complete each step. The various types of procedure sheet made by the teacher list the information necessary to complete the project in that particular area, *i. e.*, woodworking, procedure sheets for woodwork; metal working, sheets for metal work, etc.

The analysis and planning sheet is made by the student in correlation with the procedure sheet. On this sheet the student gives the following information:

1. Reason for making the project.
2. The kind of material to be used.
3. The finish to be applied to the project.
4. The bill for the material used.
5. The procedure to be followed and the tools to be used.

Field Trips

In aiding the student to appreciate the work being done in modern industry, well-organized field trips to industrial plants, construction jobs, and other places of interest are advisable. Under these natural conditions, the student can obtain a true picture of the work being done, as well as an idea of the existing conditions.

To derive the full educational value from a field trip, the teacher takes the following provisions into consideration:

1. Planning in advance for the trip.
2. Personal visit to the site.
3. Prepared notes concerning things the students should observe.
4. Preparing a report form to be filled in by the student after the trip.

The results of using these field trips may be summarized:

Advantages

1. The student gets the smell of industry.
2. He sees industry as it actually is.
3. He gets firsthand information.
4. He gets ideas of existing conditions.
5. He meets people connected with industry.

Disadvantages

1. The trip interferes with schedule of student.
2. A number of competing attractions takes away the emphasis from the important points.
3. Rarely possible for all students to get near enough to important phases of work to get a true picture of conditions as they exist.
4. Oral explanations are not easily heard.
5. Liability has to be considered.

Models and Mock-Ups

A model is a miniature of the actual object. Some models are made full scale if they are small. These models help a student visualize what the object will look like when finished.

Mock-ups are full scale models constructed in such a way that each piece can be taken apart to show the actual construction. This is also an aid in helping a student to visualize the various stages in construction of the job.

Motion Pictures and Filmstrips

Included in the pedagogic creed of John Dewey is this statement:

. . . the image is the greatest instrument of instruction. What a child gets out of any subject presented to him is simply the images which he himself forms with regard to it.

The sound motion picture is a natural vehicle for effective learning—it embodies sight, sound, sequence, and motion.

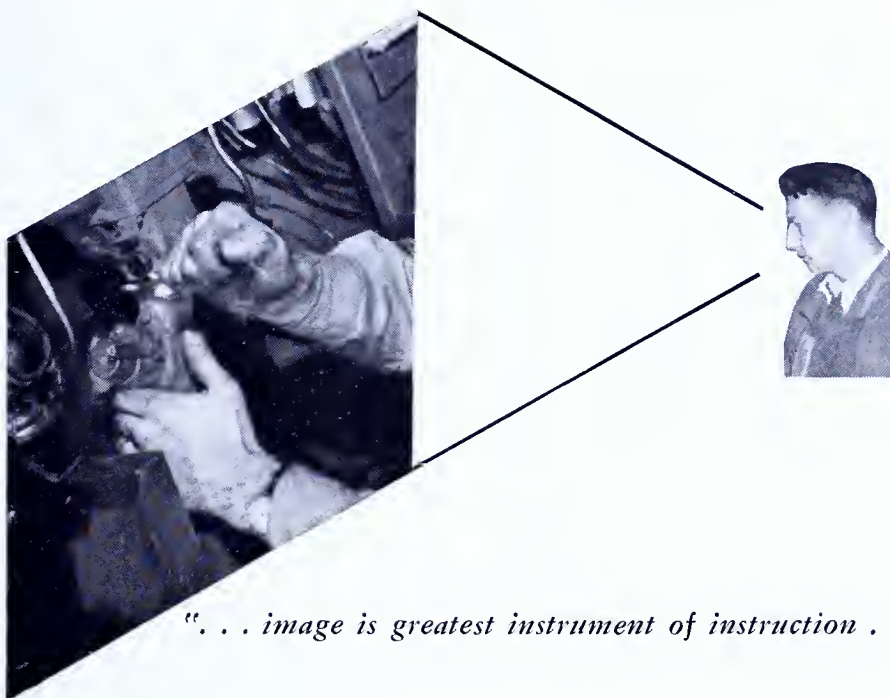
The following procedures should be observed in using any of the visual aids:

1. Students must be prepared by a preview for the picture that is to be shown.
2. Tests should be given or notes taken on the film as would be expected in a lecture or demonstration.
3. Maintenance of classroom attitude is required if students are to benefit from this type of instruction—it is not just another show.
4. Repetition of the film is advisable rather than showing too many pictures at one time.

Motion pictures, as any other instructional aids, are used not to replace the teacher but as a supplement to his instructions.

In obtaining films it is helpful to know that many industrial and commercial firms have produced films which contain little advertising and are excellent for use in the classroom. These films are obtainable in 16 mm width, sound or silent, and are printed on safety stock which does not require the use of a booth for projection. An annotated index of films should be kept up to date by the teacher.

Although the motion picture is excellent for depicting continuity of action as well as the unobservable action, it has its limitations. In such a case, another visual aid may be used.



"... image is greatest instrument of instruction ..."

Filmstrips, sometimes called the "picturol," is a series of pictures on 35 mm film. The rolls contain varying numbers of frames consisting of pictures, charts, diagrams, etc. with explanations either on the film, on record, on tape, or in a teacher's guide which accompanies the filmstrip.

The greatest advantage of the filmstrip lies in the fact that the cost is minimum and the filmstrip can be made by the teacher.

While the filmstrip, unlike some motion pictures, requires more effort and explanation from the teacher, another advantage is obtained by being able to keep the picture on the screen for any necessary length of time.

Advantages and Disadvantages of Films and Filmstrips

Advantages

1. Does not interfere with schedule of the student.
2. Student's attention concentrated on subject at hand.
3. All students are near enough to important phases of work which may be in progress.
4. Explanations given in connection with picture easily heard.
5. Motion can be suspended whenever necessary for further study of details.

Disadvantages

1. Motion pictures do not always give a true picture of conditions as they exist in industry; only the best side is shown.
2. Student does not get a "smell" of industry.
3. Many students think of pictures as just another show.
4. There is no personal contact with the person giving the explanation.

Sources of Films, Filmstrips and Slides

American Council on Education
744 Jackson Place
NW Washington, D. C.

Art Education, Inc.
6 East 34th Street
New York City, N. Y.

Audio Film Center
45 West 45th Street
New York 19, New York

Castle Films
1445 Park Avenue
New York 29, New York

Colorcraft Studios
6 North Michigan Avenue
Chicago, Illinois

Coronet Films
Coronet Building
Chicago 1, Illinois

Encyclopaedia Britannica Films, Inc.
Wilmette, Illinois

Films Incorporated
330 West 42nd Street
New York 18, New York

Ideal Pictures Corporation
65 East South Water Street
Chicago 1, Illinois

The Jam Handy Organization
Educational Films Department
2900 East Grand Boulevard
Detroit 11, Michigan

Knowledge Builders
625 Madison Avenue
New York 22, New York

Long Filmslide Service
944 Regal Road
Berkeley, California

National Studios, Inc.
145 West 45th Street
New York City, New York

New York Scientific Slide Co.
28 West 39th Street
New York City, New York

Popular Science Publishing Corp.
353 Fourth Avenue
New York City, New York

Society for Visual Education, Inc.
100 East Ohio Street
Chicago, Illinois

U. S. Office of Education
Federal Security Agency
Washington 25, D. C.

United World Films, Inc.
1445 Park Avenue
New York 29, New York

Vocational Guidance Films, Inc.
215 East Third Street
Des Moines 9, Iowa

Young America Films, Inc.
18 East 41st Street
New York City 17, New York

Pennsylvania Film Libraries

Bloomsburg State Teachers College
Bloomsburg, Pennsylvania

California State Teachers College
California, Pennsylvania

Clarion State Teachers College
Clarion, Pennsylvania

East Stroudsburg State Teachers
College

East Stroudsburg, Pennsylvania

Edinboro State Teachers College
Edinboro, Pennsylvania

Indiana State Teachers College
Indiana, Pennsylvania

Kutztown State Teachers College
Kutztown, Pennsylvania

Lock Haven State Teachers College
Lock Haven, Pennsylvania

Mansfield State Teachers College
Mansfield, Pennsylvania

Millersville State Teachers College
Millersville, Pennsylvania

The Pennsylvania State College
State College, Pennsylvania

Shippensburg State Teachers College
Shippensburg, Pennsylvania

Slippery Rock State Teachers College
Slippery Rock, Pennsylvania

West Chester State Teachers College
West Chester, Pennsylvania

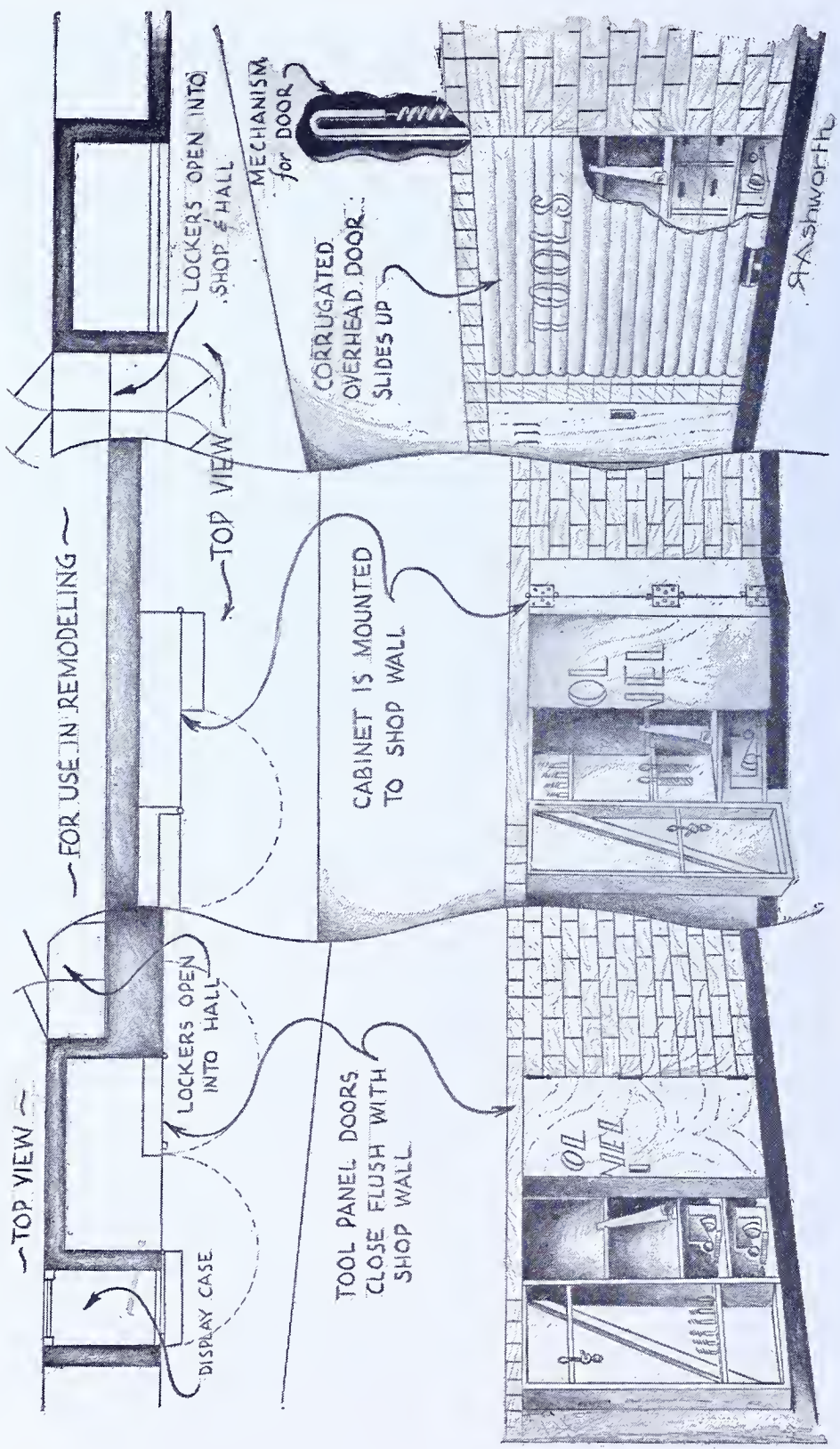


Well-Organized Tool Storage

Control of Tools and Supplies

Tools and supplies that are constantly used should be stored as near as possible to the area where they are used. A large central toolroom to house all the tools is not satisfactory for the handling of tools for the Industrial Arts shop. Tools and supplies can be more conveniently handled on a tool panel either on the wall or by means of a movable folding cabinet on casters.

A tool panel should be provided for each area of the shop. If these panels are of the movable type, they can be stored compactly in a storage area when not in use. All tool panels should be arranged so that the teacher may check the tools in as short a time as possible. The silhouetting of the tools on the panel board will greatly assist checking.



Method of Storing Tools and Keeping Them in Circulation



A Roll-Away Tool Cabinet

Supplies other than those in constant use may be stored in a metal storage cabinet. Several metal cabinets should be supplied to the Industrial Arts shop for the storage of supplies, tool replacement, projection equipment and materials.

The Pupil-Teacher Planning Area

Industrial Arts instruction is analyzed under purposing, planning, executing, and judging. The functions of purposing and planning require a specially equipped and organized area distinct from the working area. These functions involve reading, study of project books, sketching, drawing, listing of work processes, making bills of materials, and planning the work procedure.

An area approximately 350 square feet separated by a glass partition from the shop proper makes an ideal planning center. This room should be equipped with the teacher's desk, chair, and filing case. It should include at least four drawing tables, a library table with four or more chairs, and library cases for reference and projects books and blue prints. Here individual and group projects are proposed and planned, some students explore drawing interpretation and practice, and the teacher has a desirable headquarters for his desk work and student conferences.

Aids for Student Project Selection and Planning

Student project selection in grades seven, eight, and nine will require more teacher-student planning than in the upper grades. The teacher must carefully guide and advise the student so that projects out of the range or capacity of the student, shop equipment, facilities, or materials will not be attempted. This may be controlled to some extent by limiting the shop library and project files to books and magazines which deal with projects within the capacity of the shop's physical setup and the students' abilities.

File folders containing drawings or references for each grade in the various areas will help. Only projects suitable for choice of seventh grade students should be in the seventh grade folder.

Reference books and magazines will direct the students' attention to the sections which concern them, thus pointing a path of study rather than depending upon the students' careless browsing.

Vital in leading the student in planning projects, are the enclosed display cabinets or other facilities where not only the teacher's work is displayed but also the work of outstanding students. When a student has shown unusual ability, for example, in making a plastic-handled screw driver, he will be quite eager to make another for the display case. Of course he will have his name, grade, and the date produced attached to the displayed project. It is quite difficult to challenge a student when a teacher's model is the only one available. When the student's older brother's or sister's projects are on display, it creates the urge to do as good or better.

After the project has been selected, references should lead the pupil to the library facilities of the planning area where he will find suggestions about materials, construction processes, and finishing operations. The idea is to stimulate orderly procedure and good work habits,

which should prevent disappointment or failure to complete a satisfactory project.

Group planning of a suitable project which would have common appeal should be done when possible. For instance, in graphic arts a Christmas card or place card for a holiday made by the silk screen process will stimulate designing as well as student project organization. This will challenge the student of simple manipulative ability, as well as the student capable of being foreman in charge of the entire production process. Valuable cooperative real life problems guided by the teacher will be solved by the students in a democratic way.

In grades 10 to 12, the planning process from the idea to research may require a more extensive shop library to illustrate the processes involved in creating an industrial project. Often each step or process will not be foreseen; however, systematic procedures and processes will have been planned in the majority of cases.

Good design can be emphasized by the Industrial Arts teacher. A design committee of students may pass on the "eye appeal" of an individual student's plan. The project proudly displayed builds up the Industrial Arts program. Utility, good sturdy construction, aesthetic design, and the appropriateness of materials and finish must enter into the designing process.

Housing and Layout for Industrial Arts

Steps in Planning Industrial Arts Shops

1. Hold a conference with the area coordinator of Trade and Industrial Education to discuss the proposed Industrial Arts program.
2. Describe in some detail the educational activities to take place in the shop. The teacher, the supervisor, the administrator, the advisory committee and the group of participants concerned with the educational program should participate in the planning.
3. Determine the shop load—the number of students to be accommodated, the time available for instruction, the age and grade levels of the students, and the size and number of the classes.
4. Become acquainted with current codes and standards for the construction of school shops and from this study develop a reference check list applicable to the shop being planned.
5. Hold a preliminary conference with the architect, discussing educational activities, shop load, standards, building design, space considerations, and cost limitations for guidance in further planning.

Visits, with the architect, to well-planned schools and industrial shops are recommended.

6. Make a list of the equipment, tools, and supplies to be used in the shop.

7. Decide the principal areas, facilities, and auxiliary rooms needed.

8. Draw, in consultation with the architect, a preliminary shop floor layout to scale, showing location of principal areas, facilities, auxiliary rooms, and equipment.

9. Prepare, for the architect, a description of the shop and set of specifications made by the teacher to explain and supplement the floor plan.

10. Assist the architect in the revision of the preliminary plan, answering additional planning problems posed by the architect. Detail sketches of built-in equipment should be provided at this time.

11. Assist the architect by providing answers to questions of detail as they appear during final planning and construction.

The Shop Building

1. School shops should be housed in one or more shop buildings or shop wings planned as integral parts of the total educational plant.

2. Shop buildings or shop wings ideally should be one story in height.

3. Building units should be connected by covered-walk passages.

4. The site area devoted to Industrial Arts should be large enough to provide for future expansion; it should be adjacent to or connected with the academic unit site area (not isolated); and it should be near the street for automobile and truck access.

5. Noisy school shops such as sheetmetal and art metal should be located so that they do not disturb other school activities. This does not mean isolation.

6. Shops should be located so that they are accessible for adult use.

7. Heavy equipment shops should be located on the ground floor.

8. In a multiple story shop building the floor location of shops should take into consideration floor equipment load, service requirements, accessibility to the public, natural lighting requirements, and elevator service requirements.

9. School shops should not be located in basement areas.

10. Shops should be acoustically treated for auditory comfort.

11. Acoustical material used should be capable of being stained and restained without losing its acoustical properties.

12. Shops should be located away from play areas.

13. Shop ceiling height should not be less than 10 feet 6 inches, preferably 14 feet.

Types of Construction

Steel skeletons or reinforced concrete skeletons on nonload-bearing walls are found to be stable. Careful supervision of plans and construction on the job will eliminate poor design, cracked, leaning walls, sagging roofs, falling ceilings, or deviations from specifications. Can the building withstand extreme winds, floods, earthquakes, and complete loads of students and equipment? Plans submitted to the State Department of Public Instruction are carefully checked on these points.

Hollow Tile

Hollow tile with brick or ceramic facings have been put to use, resulting in pleasing exterior and interior results. Some insulating value is found in dead air space within the tile. Hollow tile combine speed of laying with the appearance of brick or glazed tile.

All-Steel

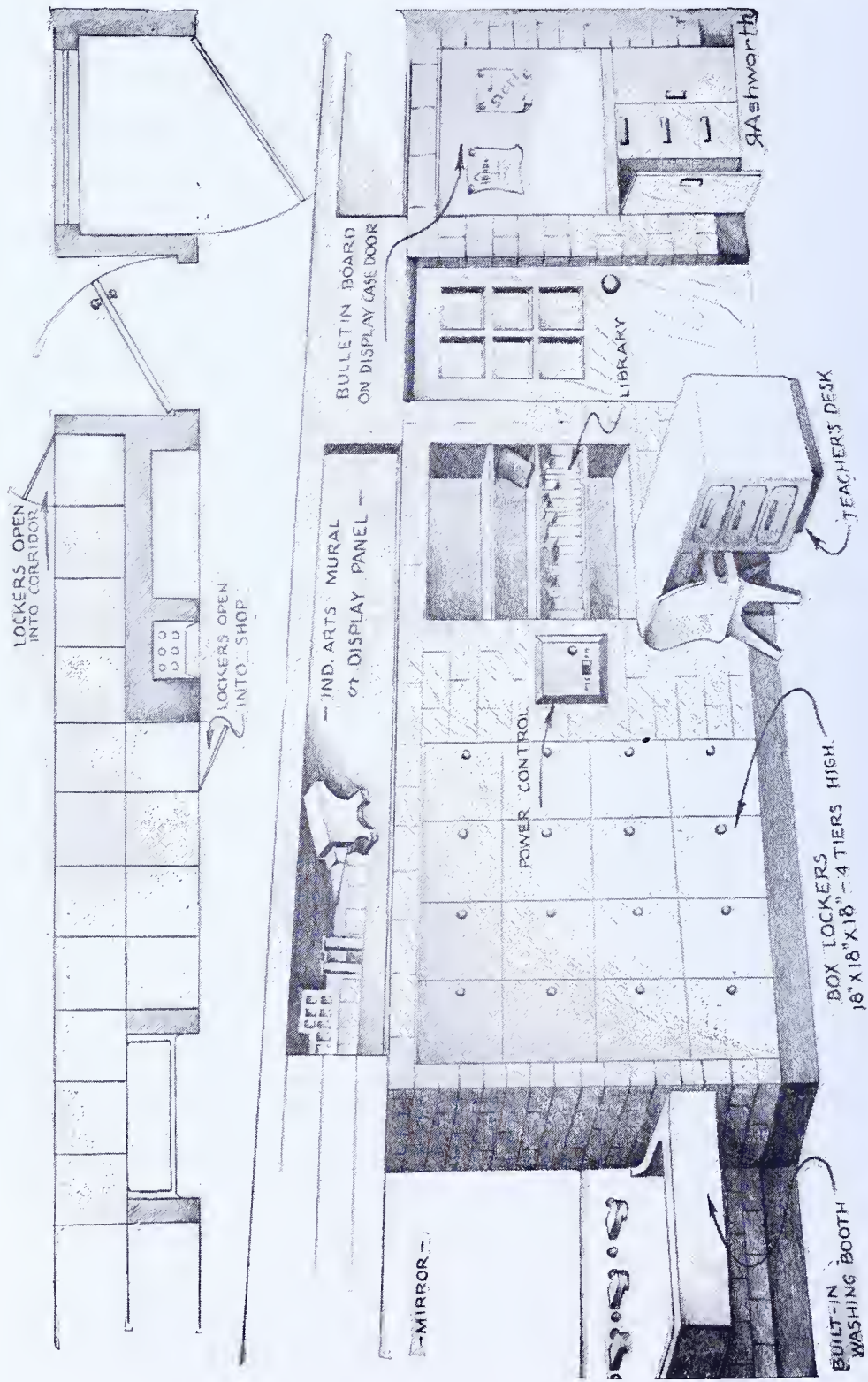
Maximum fireproofing is attained in all-steel construction. Fire is an ever-present possibility even though few fires occur. The expense of this construction may be brought down when local codes are adjusted to good engineering practice, utilizing lighter steel members. With proper insulation and modern enameled steel units of construction durability and beauty can be attained, with minimum fire risk.

Concrete Block

In general concrete blocks are considered substantial and economical. A great variety of sizes and face appearances are available in most sections of the country. A durable building results when blocks are properly cured and laid. Painting inside and outside adds a pleasing appearance to this type of construction. Where cement plaster is used for a wainscot, and insulating plaster for the upper wall, a quality job is attained and some insulating value is afforded by the dead air space in the blocks.

Cinder Block

Cinder block, available in several standard sizes, is low in cost, possesses sound deadening qualities when not plastered, and may be



Use of Walls in Planning the Industrial Arts Shop

painted to present a good appearance. Light reflection is not so great as on smooth plastered walls. A wainscot of glazed brick is usually built to the height of four or five feet. This construction lends itself best to low cost separate shop buildings. Blocks must be well-made, with proper curing time allowed.

Brick

Brick work is expensive but is often used because a sense of well-being is felt when a community has a brick school building. The raked joint, while pleasing in appearance, leaves the mortar loose on the surface which invites water penetration. In northern climates this water freezes, breaking down bits of mortar until cracking occurs. With brick work too thin, buttering of the end joints provides an entry more readily for this water. Repointing is very expensive. When brick and backup tile construction are used, a certain amount of insulation is provided by the dead air space in the tile.

Formed Concrete

Because of the high cost of brick work, reinforced concrete construction has found favor in recent years. However, with the increasing cost of carpentry work on forms, the cost is nearly equal. This presents the matter of choice based on community preference. Brickwork lends itself to conventional design, while formed concrete is adaptable to modern design. Structurally-reinforced concrete is sound and compares favorably with steel skeleton construction. Care must be taken to see that expansion joints are adequate so that hairline cracks are not the result of overexpansion. Where these cracks occur, water may enter and any freeze increases the size of the crack. There is little or no insulating value to solid reinforced concrete.

Flexibility and Expansibility

1. Partitions between shops should be nonbearing curtain walls as free as possible from mechanical and utility installations.
2. Fenestration pattern should be continuous along the entire wall rather than grouped especially for each shop.
3. Heating and lighting services should be engineered so that controls serve relatively small areas within the shops.
4. Conduit and other utility supply services should be based on a liberal rather than restricted estimate of future needs.
5. Cabinets, lockers, shelves, and workbenches should be standardized as far as possible.

6. Shelving in cabinets, lockers, and other shelf areas should be of the adjustable type, except where safety requires rigid shelving.

7. Corridors should be carried through to outside walls wherever extensions are possible. Stairs should be placed in separate enclosures off the corridor rather than in corridor ends.

8. Ample site area should be left undeveloped where building additions are logical.

9. Partitions between shops should be so constructed that they can be removed to convert two shops into one, three shops into two, or other space arrangements as conditions in later years warrant.

Dimensions

The dimensions of proposed shops place certain limitations on student capacity and equipment layout. The size and quantity of equipment will vary with the age of students to be taught and the extensiveness of the Industrial Arts program.

The following space allotments are recommended as a guide in establishing total work and auxiliary service areas for one teacher to accommodate a class of 24 students:

	<i>Junior H.S.</i>	<i>Junior-Senior H.S.</i>	<i>Senior H.S.</i>
Total area	1,600 Sq. Ft.	2,000 Sq. Ft.	2,200 Sq. Ft.
Work area per student	40	60	60
Planning area	250	350	400
Storage—stock	150	200	150
Storage—projects	150	200	200
Finishing area	50	100	100
Toilets and lockers	require consideration either in the shop or in combination with other facilities		
Washing and drinking			
Exhausts and wastes			

It is frequently possible to effect economy of space when providing more than one shop unit by combining facilities.

Project storage can best be provided in 3' x 3' x 3' cubicles arranged along one side wall, or the unit may be used as a movable partition between auxiliary areas. Twenty-four such cubicles would make a wall eight units long by three units high. Selected cubicles may be used for hardware and small supplies by the use of shelves, doors, and lock.

Open Shop Area

1. There should be no obstruction which would prevent the teacher from looking over the entire open shop area from any point in it.

2. The shop teacher(s) should have headquarters in the open shop area, or an office with clear glass windows, equipped with one or two desks, chairs, and files, so placed that they command a full view of the entire shop. This headquarters should be close to the student entrance.

3. Arrangement of equipment should be determined by considerations of safety, instructional efficiency, and industrial practice in the order named.

4. The size and shape of the open shop area should be determined in large part by the equipment arrangement plan.

5. Equipment and work stations should be so placed that there is no danger of interference with adjacent students.

6. Equipment and work stations should be placed, where possible, so that related activities are in close proximity.

7. Distinct aisles of travel should be provided for free flow of student traffic between all areas and points of common usage, such as storage rooms, toolrooms, and common machine areas. Aisles of travel should be not less than four feet, preferably five feet wide.

8. Spacing between benches, machinery, equipment, and aisles should be sufficient for safety and free passage. This is determined by the nature of the shopwork and the equipment involved, but should be not less than three feet, preferably four feet.

9. Machines around which danger zones exist should be adequately guarded and lines painted in green or in contrasting color on the floor around the machines to indicate danger zones.

10. The floor area for the operator at jointers, saws, and the like, should be covered with a nonskid safety paint.

11. All shops should have at least two exit doors, one of which should be larger than the largest piece of equipment or instructional project to be moved in or out of the shop.

12. Open spaces should be provided near entrances and exits to eliminate congestion.

13. A clear floor space (four feet to six feet) should be provided in front of the tool panels.

14. An open assembly area should be set aside in general shops, wood shops, and other shops requiring space for assembling of projects.

15. If lumber, bar steel, and other materials are to be stored in the open shop area, special racks and shelving should be provided. However, it is usually very much preferable to keep these and similar materials in a storeroom.

16. Equipment, except for the portable type, should be fastened securely to the floor, a heavy bench, or other stable foundation.

17. Machines that create a vibration problem should be cushioned with rubber or felt mountings or other shock-absorbing material.

18. Bases for cabinets, benches, and machines should provide toe space for the comfort of the student.

19. Machinery should not be mounted on columns or against pipes if these will transmit noise to other parts of the building.

20. Equipment occupying floor space should be placed to allow for ease of cleaning around the base.

21. Operation level of equipment should be set at the average elbow height of the students.

22. The start-stop switch box should be located within easy reach of the student.

23. Machines which are used primarily in roughing out stock should be placed near the stock room.

24. Lockers for the storage of students' belongings, and for partially completed small projects should be provided in all school shops.

25. A satisfactory size for student project lockers is 18" x 18" x 18". They should open into the shop whenever possible.

26. Separate, additional lockers should be provided for adult evening classes.

27. Lockers should be placed on a six-inch foundation. They should be built as an integral part of the building.

28. The locker area should provide space for changing clothing.

29. The locker area should be so located that it can be readily supervised by the teacher.

30. Lighted exhibit and display cases should be provided both in the shop itself and in central locations in the principal part of the school plant.

31. Power and light controls should be centralized on a locked master control panel, with pilot light, and located if possible near the teacher's desk or office.

32. Additional safety buttons (anyone of which will turn off all power in the shop) should be located at intervals around the shop.

33. Shops using portable power tools should be provided with one double electric wall outlet every ten feet of wall space.

34. A washing station should be provided for every five students in the shops.

35. Hot water should be available in all shops.

36. Every shop should have a drinking fountain, located in a place where it will not cause congestion, but in view of the teacher.

37. Provision should be made for one or more bulletin boards placed in strategic positions such as the entrance to the shop or near the stock room.

38. Fire extinguishers must be part of the shop service equipment, located conveniently near points of danger and marked or labeled conspicuously.

39. Provision should be made for location of the shop first-aid kit in the teacher's area or office.

40. A space should be set aside in each shop for a waste and refuse container. In the shops that accumulate considerable waste and refuse the container should be mounted on rollers to facilitate collection.

41. Gas welding tank storage should be located outside of the shop, preferably close to the driveway.

Auxiliary Rooms and Facilities

1. The number and kind of auxiliary rooms and areas depend upon the type of shop, but all shops require auxiliary rooms and areas of one kind or another which should be planned along with the rest of the shop (planning room, supply room, storage room, shop classroom or instructional area, shop office, finishing room, toilet room).

2. Every shop, or group of related shops, should have its own supply storage room, the size determined by the nature of the shopwork, the number of students to be provided for, and the type and quantity of supplies to be stored.

3. The location of the supply room should facilitate unloading from delivery trucks and storing of supplies and should be convenient for issuing supplies to students.

4. The lumber supply room or other supply room storing heavy or bulky material should be located, if possible, so that delivery trucks can unload directly into it. For these rooms the doors in the opposite end should open directly into the open shop area.

5. With few exceptions each unit shop should have its own tool panels.

6. Separate supply storage and project storage facilities should be provided in shops which are to be used extensively by adult classes.

7. Racks, shelving, drawers, cupboards and cabinets, designed for items to be stored, should be provided in the supply storage room and toolroom.

8. The Industrial Arts teacher will need to use a classroom on occasion for visual aids, demonstrations, discussion of field trips, etc. This facility should be utilized about 15 per cent of the scheduled class time.

9. The grouping of chairs in an open shop area is the poorest possible situation for homeroom accommodation or group instruction. The area and the chairs are used only a few hours per week and, therefore it makes a wasteful arrangement.

10. When three or more shop units are provided, especially at the senior high school level, consideration should be given to a separate graphic arts unit large enough to accommodate from 12 to 15 students in drawing and related activities plus composition, presswork, book binding, silk screen and the visual aid facilities for the Industrial Arts program.

11. If instruction space in the open shop area is used instead of a classroom, it should be provided with a teacher's desk, demonstration table or bench, portable chalkboard, tablet armchairs, and cabinets for storage of instructional materials.

12. Separate locker space should be provided for use of evening school teachers.

13. Toilet facilities should be provided for in the shop area unless the over-all building plan provides general toilet facilities. The shop location is preferable.

14. A separate dustproof finishing room equipped with an independent exhaust system is recommended for wood shops, cabinet shops, and other shops where project finishing is done.

15. Shop classrooms or other classrooms should be equipped for showing films including electrical outlets and controls, and built-in screen.

16. Electrical outlets and controls should provide for a minimum of teacher movement, with outlet and controls for room lights and projector at one point.

17. A special cabinet on wheels is recommended for moving projection equipment from one room to another.

Visual Comfort and Efficiency Lighting

1. Full advantage should be taken of the possibilities for natural lighting through maximum window area, bilateral lighting, and overhead lighting. North and east light should be secured whenever possible.

2. Natural light should be supplemented by artificial light to the extent that the artificial light alone will provide illumination that conforms to adopted standards.

3. Artificial lighting systems should produce a uniform distribution of shadow-free and glare-free illumination.

4. General artificial lighting should be by indirect or semi-indirect fixtures, incandescent or fluorescent.

5. Artificial lighting for shops in general should produce 30 to 40 feet candles of light on the work. Lighting for mechanical drawing and other activities where precision work is carried on should produce 50 feet candles or more of light on the work.

6. General lighting should be supplemented with additional local lighting on all machines and in areas where precision work is done.

7. Ceilings should be painted an off-white with light-colored walls, trim, and built-in equipment.

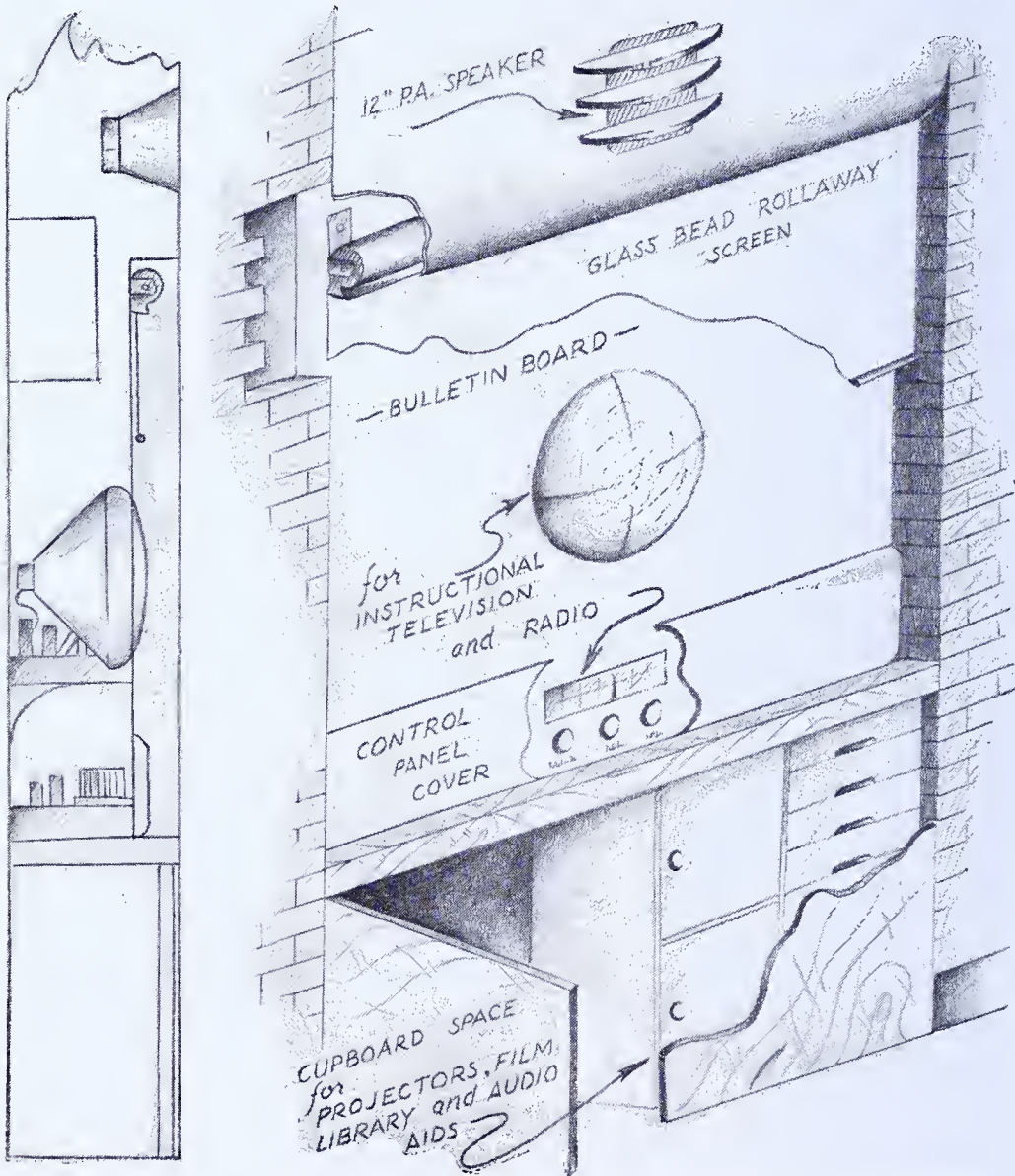
8. Furniture and other shop equipment should be finished in light rather than dark colors. Floors should be light in color. Hardwood floor should be finished natural and should never be darkened by stain.

9. Machinery and equipment should be painted in colors that will minimize eye fatigue and promote safety. (See color dynamics charts.)

10. The nonoperating machine body should be finished in receding shades (green, gray) to create a visual working area that minimizes eye fatigue.

11. Operating machine parts should be finished in colors that are in strong contrast to the nonoperating machine body to separate the critical from the noncritical and to visually divorce the critical machine parts from the material being worked upon.

12. High visibility colors should be used on control levers and switch boxes, with black for starting button and red for stop button.



Drawing courtesy California State Teachers College
Built-In Audio-Visual Center for the Industrial Arts Shop

13. Artificial lighting must be provided for all classrooms, even those used only in the daytime, to supplement the daylight on those occasions when adverse weather reduces the light level below that needed for visual performance.

14. The quantity of artificial lighting provided to supplement daylight should be sufficient to keep the light level throughout the entire room from combined sources.

15. A great number of school shops are below the ground level and airways are not large enough and small shop windows do not allow enough light to enter to the far sides of the shop.

16. Lighting equipment should be carefully chosen and installed. Luminous-indirect fluorescent lighting in rows of three or four, depending on width of shops, has greatly improved the lighting conditions of many school shops. In mechanical drawing areas it is advisable to have the rows of lights installed with the circuits separately controlled to take care of the dark sides of the area.

Ventilation and Heating

1. The heating and ventilating system should maintain comfortable and healthful conditions at all times.

2. The ventilating system should provide fresh outdoor air constantly, keeping it gently in motion.

3. Dust, smoke, odors, fumes, vapors, and gases should be exhausted by mechanical means.

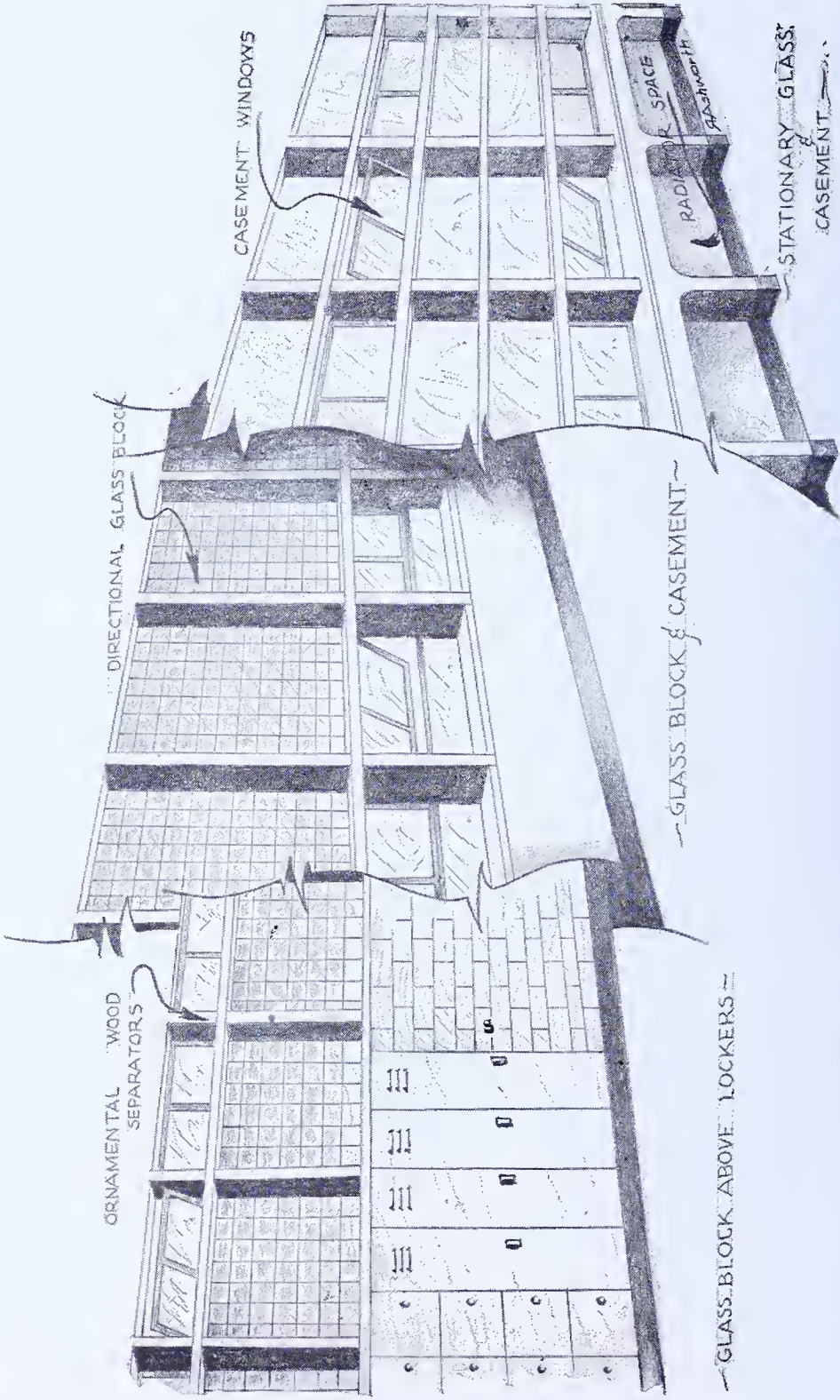
4. The heating system should maintain automatically a temperature of 68° measured 60 inches above the floor for shops, 70° measured 30 inches above the floor for classrooms.

Flooring

1. Flooring selected should have a wearing surface designed to endure but not so nonresilient as to cause undue fatigue from walking. It should be insulated to reduce noise in the shop and prevent transmission of noise to other shops and classrooms.

2. Flooring should present a pleasing appearance, be easily cleaned, require a minimum of repairs, and be finished to reduce the danger of slipping.

3. Flooring materials will differ from shop to shop and within a particular shop to meet the needs of the activity to be accommodated. The following common flooring materials rated "S" are considered satisfactory for the shops and areas indicated. Those rated "1" are considered first choice.



Fenestration of Industrial Arts Shop

RECOMMENDED FLOORING FOR INDUSTRIAL SHOPS

<i>Shop</i>	<i>Maple</i>	<i>Vert. Grain Douglas Fir</i>	<i>End- Grain Wood Block</i>	<i>Concrete</i>	<i>Lino- leum</i>	<i>Asphalt Tile</i>
General Shop	1	S	S			
Wood, Cabinet Carpentry	1	S	S			
General Metal Sheet Metal	S	S	S	1		
Electric, Radio	1	S			S	S
Crafts	1	S			S	S
Graphic Arts Printing	1	S			S	S
Mechanical Drawing Drafting	1	S			S	S
Auto Mechanic Body & Fender				1		
Aviation				1		
Machine Shop			S	1		
Welding				1		
Foundry				1*		
Forging				1		
General Classrooms Offices	1				S	S

* An earthen floor is preferred.

Color

Color has a definite effect on the health, comfort, happiness, and safety of the individual.

Colors can stimulate or depress people. Some colors can relax and produce cheer, while still others can stimulate and invigorate. Colors must be carefully selected since some colors tend to irritate and cause physical discomfort.

Proper color and light affect quality and quantity of work.

The first place to check for color improvement is in the shop machinery. For years it has been the practice to paint machinery in dark, light-absorbing colors, whereby the work in process is invariably lost in the background of the machine. Shadows obscure the vision of workers. To overcome this, the body of the machine should be painted in neutral shades. The use of an individual light with light colors is utilized to provide maximum visibility at the critical area.

The student's visual field is not limited to the machine, but extends to adjacent walls, ceiling, and floor areas seen by the student as he raises his eyes from his work. Therefore, the proper selection of color for the surrounding field of vision becomes important, and severe contrasts and glare should be eliminated.

School shops and drawing rooms painted "eye-rest green" will be found to be practical.

Other colors as suggested by the National Safety Council are fire protection red, safety green, visibility yellow, traffic white, gray or black, alert orange, and precaution blue.

Acoustical Treatment

The school shop, gymnasium, halls, and auditorium need acoustical treatment—or controlled sound. Maximum efficiency can be attained when noise is held to a minimum. This may be accomplished when good hearing conditions exist and undesirable sound is controlled and sound transmission is reduced from room to room.

Acoustical materials must be carefully chosen for the particular room or location. In some rooms only the ceiling will need soundproofing, in others, walls and ceiling will need attention. Only an experienced sound engineer can judge the most efficient treatment needed. The acoustical material should have a noise reduction coefficient of 60. Federal specifications¹ SS-A-118a groups acoustical units into four types with various classes under each type.

Materials are further graded on the basis of their noise-reduction coefficients. A coefficient of 60, for example, means that one square foot of the material has sound absorbing qualities equal to 60 per cent of one square foot of an area of perfect absorption, such as an open window. The grade selected should be based on the noise-reduction or sound-absorption coefficient which will reduce the reverberation time to the acceptable range.²

Paintability is an important factor in school shops where dust and vapors are usually present. A material with good hole depth and diameter may be sprayed, rolled, or brushed, when painting becomes necessary. Fire resistance should meet local code rulings. Where partially combustible materials are cemented directly to the plaster the material will burn more slowly. Where furring strips are fastened to the concrete or plaster, the fire hazard is increased. The most dependable method is to nail the acoustical material in place. Failures are possible in cement, plaster, or where acoustical material has separated from painted surfaces (not too serious in a room where the height is not over 12 feet).

¹ U. S. Department of Commerce, National Bureau of Standards, *Acoustical Units: Prefabricated*. Federal Specifications SS-A-118a. Government Printing Office, Washington, D. C., 1948, p. 14.

² *American School Buildings*. American Association of School Administrators, Washington, D. C., 1949, pp. 191-196.

Several types of acoustical plaster are on the market, but these are not in high favor, because to be effective the mixing and method of application must be exact.

Walls

Walls are not usually considered as possessing safety factors, yet in at least four specific ways they do have vital safety value.

1. If the windows are located quite low and sidewalks are nearby, the attention of machine operators may be detracted to the extent that a serious hazard will exist. One means of remedying this is to have walls solid up to 7'-0". This would also provide vital wall space so necessary for lockers, tool panels, wall charts, and display cases. Glass block or translucent glass used in the windows at eye level or lower will effectively eliminate this hazard.

2. In extremely noisy situations as in wood and sheetmetal shops, the walls may need acoustical treatment.

3. The use of suitable colors in the shop can promote safety by giving high visibility to machine parts, barriers, close clearances, and edges of openings, and by identifying particular types of hazards.¹

4. Partitions should have windows closely spaced so that the whole space partitions prevent complete visibility of the whole working area. U- or L-shaped rooms are a serious hazard.

Chalk boards are a part of the wall and as such should be of a durable restful color with a light-reflection factor of 20-25 per cent. Boards should be a material which will not break in long, jagged pieces.

Bulletin boards should be strategically located to arrest attention where most suitable. The material may be the conventional cork, glass, or composition. With use of the present mounting tapes the latter types of material are desirable.

Windows should cover all wall spaces except where structural columns make this impossible. In general, metal frames with a means of opening an upper section for ventilation are desirable. Where glass blocks are used the ventilation section should be above eye level.

Doors should be either double or extra wide to make moving equipment possible and to allow for removing large projects. In one-story shops it is desirable to have the shop floor at truck-bed height, with a

¹ *American School Buildings*. American Association of Administrators, 1201 Sixteenth Street, Northwest, Washington, D. C., 1949, pp. 174-175.

double outside door so that heavy supplies and equipment can be unloaded with ease and safety.

Insulation

Little can be done in insulating solid masonry walls. Windows, which account for a very large part of schoolroom and shop walls, may be replaced with glass blocks which have insulating value.

In new construction, insulation can play a major role. In all-steel construction the walls and ceiling can be adequately insulated, in fact, insulation is a necessity. When a masonry wall is used, hollow back-up tile will provide dead air space which will give insulation. Concrete and cinder blocks also provide some dead air space which gives a little insulation. Ceilings and roofs are areas readily insulated. They are the greatest inlets and outlets for heat.

Fireproof, moisture resistant, and vermin-proof material should be used. In roofs, care must be taken to prevent settling or slipping of the insulating material. Batt-type insulation should prove efficient. In ceilings, granulated or loose insulation will prove satisfactory. An insulation expert should be consulted for the correct amount and type of insulation used since it is possible to over-insulate.

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Woodworking at Shamokin

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